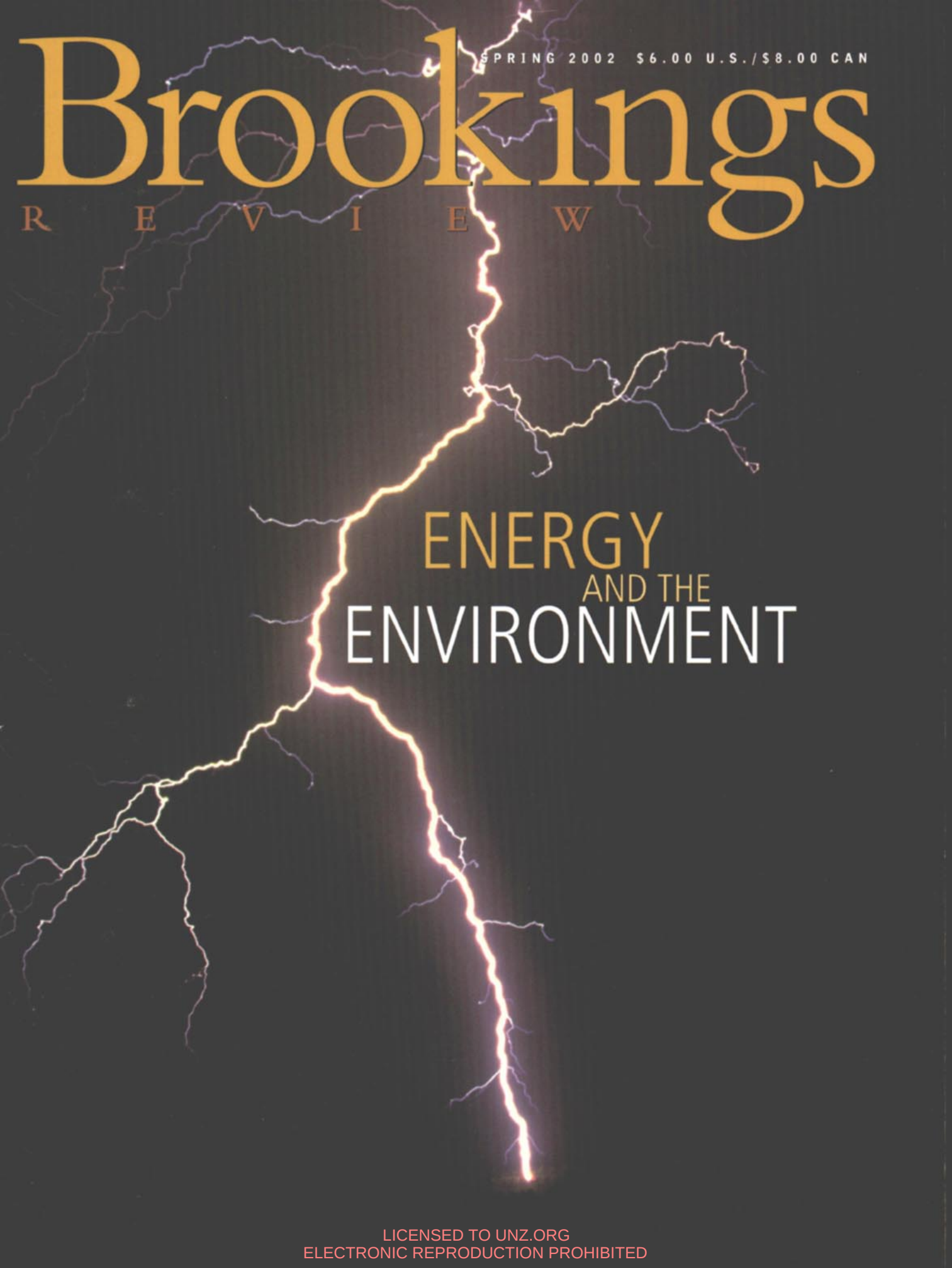




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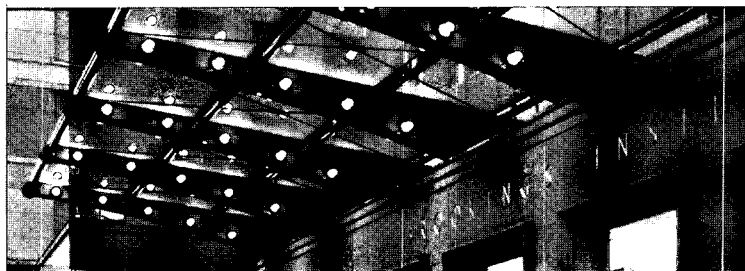
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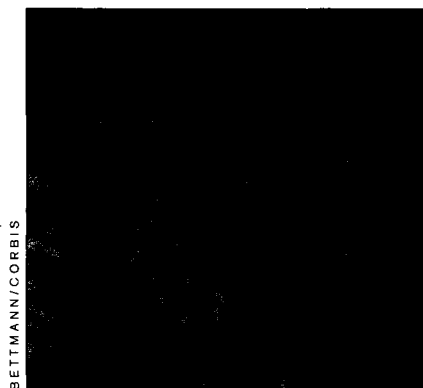


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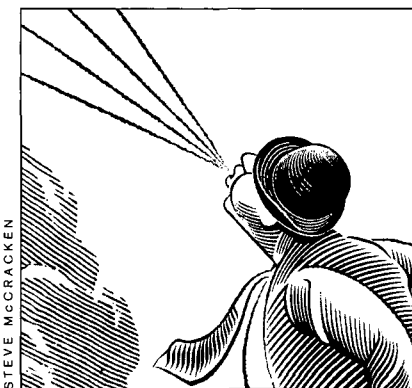
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Environmental

DOOMSDAY

The iron law of contemporary environmental understanding in the United States is: Bad News Good, Good News Bad. Though by almost every measure the Western environment at least has been getting better for decades, voters, thinkers, and pundits have been programmed to believe the environment is getting worse. Thus conditioned, Americans greet environmental bad news with a welcoming sigh as confirming the expected, while regarding environmental good news as some kind of deception. Bad News Good, Good News Bad.

During the 2000 presidential campaign, for example, much was made of Houston becoming the “smog capital of America.” But Houston’s overall air quality was improving at the time. Houston became the nation’s smog capital only because Los Angeles’s air improved even faster, passing Houston in a

icy community is ever-cleaner air and water, accomplished amidst population and economic growth. The environmental record to date shows that government programs can make the nation better and safer without harming prosperity, that industry can be regulated in ways that benefit everyone, that public policy can work. Past environmental successes give reason to hope that future initiatives, such as greenhouse gas controls, will succeed too.

Yet the false perception of environmental decline—a package of views I call “instant doomsday”—is promoted assiduously by the very environmental activists and political liberals who would likely receive much of the credit for these accomplishments were they properly recognized. To boot, voters would be shown a reason to believe that government really can accomplish things. Wouldn’t that be welcome all around? Ah, but it would violate the law of Bad News Good, Good News Bad.

race of positives. Perhaps the commentators who spoke as though Houston’s air were getting worse did not understand the issue. More likely they did not want to understand—for cleaner air would violate the rule of Good News Bad.

Environmental lobbyists intent on raising money have a stake in spinning everything in alarming terms. (Everyone is aware that corporate lobbyists have financial stakes in the positions they advocate. Why the same isn’t understood about environmental lobbyists numbers among the small mysteries of our moment.) And when environmental lobbyists depict all news as bad, most of the media reflexively echoes this line.

Arguably the greatest postwar achievement of the U.S. government and of the pol-

Cleaner Air

Most—not all—environmental indicators are now positive, at least in the United States and other Western nations.

Air pollution has declined at a pace that would be a national cause for celebration, were it not for Good News Bad thinking. (Most of the following statistics are for 1976–97. Subsequent data, due from the Environmental Protection Agency soon, are expected to show more decline in all categories.) Since 1976, the aggregate U.S. level of urban ozone, the main component of smog, has declined 31 percent. Airborne levels of sulfur dioxide, the main component of acid rain, have dropped 67 percent. Nitrogen oxide, the secondary cause of urban smog and of acid rain, has fallen 38 percent. Fine

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API/WIDE WORLD PHOTOS

soot ("particulates"), which causes respiratory disease, has declined 26 percent. Airborne lead, considered the most dangerous air pollutant when the EPA was founded in 1970, has declined 97 percent. The EPA's "Pollutant Standards Index," which measures days when air quality is unhealthful, has fallen 66 percent since 1988 in major cities.

As analyst Steven Haywood of the Pacific Research Institute has pointed out, during 1976–97, while the United States was cleaning up its air, its population rose more than 25 percent, its gross domestic product more than doubled, and its vehicle-miles traveled grew about 125 percent—all developments that might have been expected to worsen air pollution. What kept that from happening was a web of ever-stricter anti-emission regulations, ever-better technology (today's new cars emit less than 1 percent as much pollution, per mile traveled, as 1970 cars), and smart use of market forces. For example, the 1990 Clean Air Act Amendments allowed electric-power utilities to trade acid-rain permits to help them meet tougher standards. As a result, acid-rain emissions fell 50 percent during the 1990s, even as more coal, the primary source of acid-rain chemicals, was being burned.

Especially spectacular has been the improvement of Los Angeles air. The summer of 2001 was its cleanest on record. Los Angeles county has not had a "stage one" ozone alert in two years; during

By Gregg Easterbrook

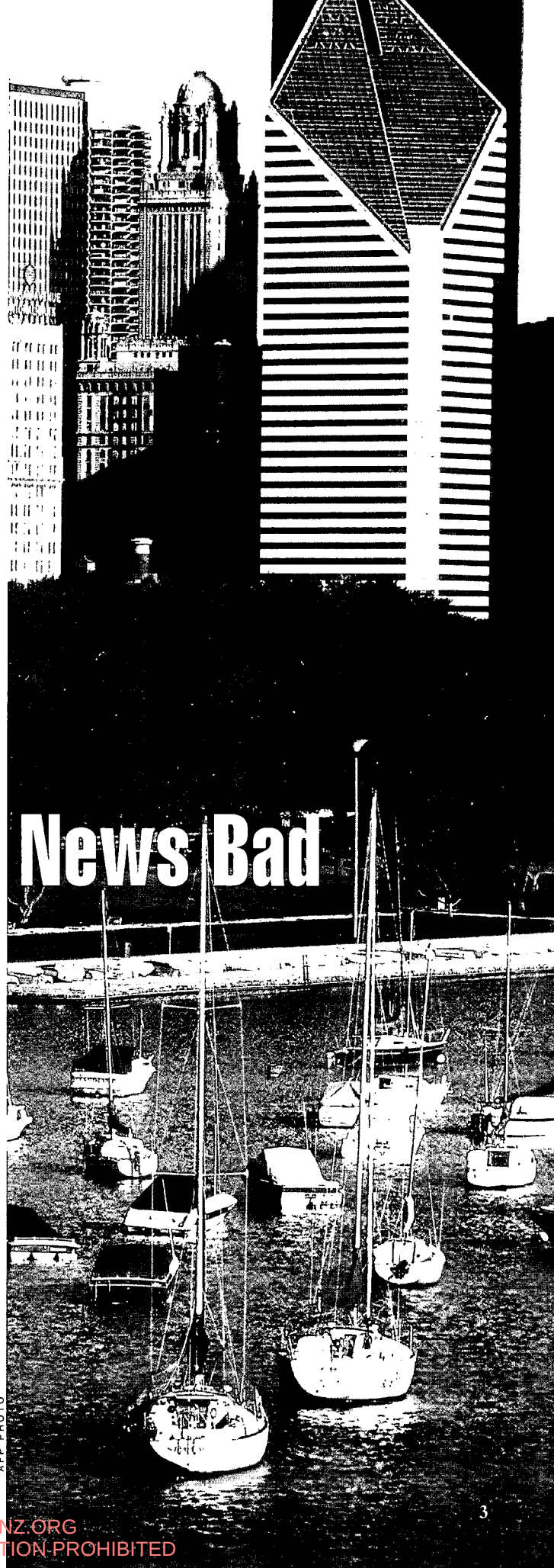
Bad News Good, Good News Bad

the 1980s, it averaged 70 stage-one warnings annually. In 2001, Los Angeles violated the federal ozone standard 36 times; during the 1980s, it averaged 165 violations a year. L.A. county officials had to issue 18 ozone "health advisories" in 2001; during the 1980s, the average was 130 a year. (And L.A. smog figures for the 1960s and 1970s were worse.) Despite the popular impression of L.A. air getting ever worse, Los Angeles smog has been declining on a pretty much linear basis since the 1960s.

Denver, New York City, and other major urban areas have drastically reduced the incidence of carbon monoxide—sometimes called winter smog—in the past decade amidst a welter of claims by environmental activists that "more and more cities are violating air standards." As the EPA makes its air quality standards progressively more stringent, cities may violate standards even as pollution levels go down.

Related Progress

Most other environmental indicators are similarly favorable. In 1970, only one-third of American lakes and rivers were safe for fishing and swimming—the principal water-purity standard of the Clean Water Act. Today the proportion is about two-thirds, and rising. Toxic emissions from U.S. industry have declined 42 percent since 1988 and not because production fled offshore—



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domestic output of the petrochemical industry, the main source of toxic emissions, grew during the period. During the past two decades municipal wastewater treatment has become universal, while the ocean dumping of sewage sludge has been banned. Boston Harbor, a decades-old source of dirty-water jokes, is on such a clean binge—thanks to the world's most advanced municipal wastewater treatment plant—that the harbor is sparkling again already and will be safe to fish and swim in soon. Land disposal of untreated hazardous wastes has been banned, and no Superfund sites today imperil public health. Energy consumption has become more efficient in almost every category with the annoying exception of the sport utility vehicle. A long-term trend of “decarbonization” characterizes energy use in the United States, the European Union, and affluent Asian nations. All these societies are burning steadily less fossil fuel per unit of energy produced.

Other improvements abound. The forested portion of the United States is increasing, not shrinking. Appalachian forests, once expected to be wiped out by acid rain, are the healthiest they have been since before the industry era, with browsing species such as deer thriving. Farm erosion and runoff are both trending down, even as agricultural production keeps rising. The American bald eagle, gray whale, and peregrine falcon have been “delisted” from the Endangered Species Act, while the oft-predicted wave of extinctions of U.S. plants and animals has yet to materialize. All these gains have coincided with unprecedented economic growth and improved living standards—proof that environmental protection and prosperity are wholly compatible. Gross pollution was necessary for economic growth a century ago; now it is not, though power plants continue to hum and factories to churn out goods.

Lingering Problem Areas

Two environmental trends in the West remain worrisome—habitat loss and greenhouse gas emissions.

Prosperity expands to fill the space available for construction. Though the built-up area of the United States is still much smaller than most people would guess—about 6 percent of U.S. land—the developed “footprint”

of the country continues to expand and must expand another 50 percent or so to accommodate the 50 percent population increase that the Census Bureau projects before the American populace stabilizes around mid-century. This means more sprawl. Before you say, “I don't like sprawl,” remember that sprawl is caused by population growth and affluence—and which of these, precisely, do you propose to ban? More development will inevitably put pressure on wild habitats. The scattershot approach of creating national parks now and then ought to be replaced with more methodical land protection. Modest proposal: legislation requiring that for every new acre developed, another be purchased and placed into preservation status. (Costs of this idea would not be onerous, as wild acres sell for far less than development-grade land.)

And the scientific case for artificial global warming continues to strengthen. Though the nightmare scenarios beloved by alarmists still seem improbable, the world has warmed slightly—9 of the 10 warmest years of the past century in the past 11 years—and there is scientific near-consensus that warming is likely to continue. The warming so far has caused no harm, but further warming might disrupt the agriculture on which the world depends or spread equatorial diseases to higher latitudes. This makes it common sense for nations to buy insurance by slowing the accumulation of greenhouse gas in the atmosphere. Most of the ways to slow carbon buildup involve improving energy efficiency and developing nonfossil power—both reforms that are needed regardless of what happens to the climate.

Today affordable progress against global warming seems inconceivable; but a generation ago, commentators called the Los Angeles smog problem unsolvable. Today no one has a financial incentive to find ways to reduce greenhouse emissions. Create a market incentive, and engineers and business whizzes would likely be brimming with ideas. Financial incentives might happen under the beleaguered Kyoto treaty. If not, the United States could move on its own by creating a system of “carbon trading,” similar to the acid-rain trading system that was both effective and affordable.

Developing Countries

The favorable environmental trends in the West do not extend to the developing world.

Increasingly the United States and the European Union approach pristine, while the impoverished parts of the world grow more polluted.

Gross air pollution from unregulated industry, from cars and trucks without Western tailpipe controls, from dirty gasoline and diesel fuels, and worst of all from indoor smoke—more than a billion people worldwide heat and cook with indoor fires—make air pollution in Lagos, Delhi, and many other developing-world cities worse than anything in the West since London in the 1950s. For a third of the world's population, safe drinking water is a rarity—or an expensive luxury. In Indonesia, for example, the poor spend a significant fraction of their income to buy a few liters of safe water from vendors; here, we pay pennies per thousand gallons. Wastewater treatment is often unknown: I've seen boys in Pakistan swimming in open sewage canals that run down city boulevards. All told, the number of children under the age of five who die each year in the developing world from gross air pollution and unsafe drinking water—two causes of death essentially eliminated in the West—is larger than the number of deaths at all ages from all causes each year in the United States and the European Union combined.

One reason Americans and Europeans need to shed the instant-doomsday misperception of their own environment is so that they can turn their attention to the genuine environmental troubles of the developing world. Americans and Europeans won't support environmental aid to the developing world if they falsely believe their own air and water imperiled. But both citizenries are generous and might back international environmental initiatives if they understood, first, that their own environments are being protected and, second, the degree of human suffering caused by ecological problems in the impoverished world.

Western environmental lobbyists tend to downplay developing-world issues, both for fundraising reasons—people scared about their backyards are more likely to donate—and because what's needed by the poor who heat

with indoor fires is clean electricity, while what's needed by the poor who buy water by the liter is central reservoir and purification systems. Western environmentalists who would never dream of going without unlimited electricity and clean water condemn such big infrastructure systems as “inappropriate” for the developing world, fulminating about the evils of power generation and dams. Few views are more detached from the reality of human needs.

General ecological need, in turn, is reflected by the threat of species loss in the developing world. For it is not the industrialized West but the developing world—where deforestation continues—that may lose species in the 21st century. And unlike pollution, which can be reversed, species loss is forever.

The International Union for the Conservation of Nature, the most credible organization in this field, lists 180 “critically endangered” mammal species and 182 bird species—more than enough to justify emergency efforts for species conservation. But most work must be done in the developing world, not the West.

What's Ahead?

Is more environmental progress practical? Absolutely.

In the United States and European Union, most environmental regulations may be characterized as effective but cumbersome—too complex and not sensitive enough to market forces. Replacing complex rules (the Clean Air Act imposes dozens of separate standards on industrial facilities) with simplified performance goals might speed the rate of pollution reduction. Environmentalists and editorialists have been conditioned to denounce any streamlining of EPA rules as a “rollback,” but what's the goal—rules or pollution reduction? Many areas of environmental law offer opportunities to use streamlining and market forces to allow more progress at lower cost.

Environmental law could also benefit

from greater use of risk analysis and trade-off thinking. Millions of dollars may be spent to, say, eliminate the last part per quadrillion of dioxin from the emissions of papermaking plants, even though there is no evidence such minute amounts cause harm, and there are many better ways the millions could be spent. EPA Administrator Christine Whitman just imposed a \$500 million Hudson River-PCB dredging cleanup on General Electric, which caused the river's PCB problems. She took the step although the harm from Hudson River PCBs is comparatively small and declining naturally anyway, and despite the fact there is no guarantee a fleet-sized dredging project will even work—it might make the situation worse by stirring up buried PCBs. Posit that General

Electric was guilty of behavior for which \$500 million is the proper penalty. The money could be far better spent buying land for preservation, housing the homeless, or perhaps protecting the watershed that provides New York City's water supply. But the Clean Water Act as written does not allow such utilitarian trade-offs. Many highly prescriptive environmental

The favorable environmental trends in the West do not extend to the developing world.

laws could sensibly be supplanted by a few simplified statutes that grant regulators discretion to pursue the general good.

For the developing world, bad as conditions are, there is reason to hope. Air pollution in Mexico City, one of the world's most polluted urban areas, has declined for each of the past two years, mainly because Pemex, the Mexican petroleum concern, has begun reformulating gasoline to reduce its inherent pollutant content. Mexico City has a long, long way to go to clear its air. But just a few years ago the city's situation was commonly described as desperate; now there is guarded optimism. Developments of that sort might be seen as something to celebrate, if it weren't for Bad News Good, Good News Bad. ■

CLIM

By Warwick J. McKibbin and Peter J. Wilcoxen

ATE CHANGE after Kyoto

A Blueprint for a Realistic Approach

In 1992, the United Nations Earth Summit in Rio de Janeiro produced a landmark treaty on climate change that undertook to stabilize greenhouse gas concentrations in the atmosphere. The agreement, signed and ratified by more than 186 countries, including the United States, spawned a decade of subsequent climate negotiations, but has had virtually no effect on greenhouse gas emissions. It has not even produced a detectable slowing in the rate of emissions growth.

The treaty's implementing protocol, the 1997 Kyoto agreement, has not been ratified by any major emitter of heat-trapping gases, has been rejected by the United States, and has been spurned by developing countries. At the same time, the relatively stringent emissions targets negotiated in Kyoto have been so diluted in subsequent negotiations that it would likely take another decade for the protocol to begin to deal with the problem of climate change.

Warwick J. McKibbin is a nonresident senior fellow in the Brookings Economic Studies program and professor of international economics at the Australian National University. Peter J. Wilcoxon is a professor of economics at the University of Texas. This article is drawn from their forthcoming book of the same title (Brookings, 2002).

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The primary cause of this failure has been the inability of the treaty negotiators to cope with the uncertainty that surrounds every facet of climate change—how much global warming will take place and when, how much damage it will cause, how costly addressing the damage will be.

The prevailing uncertainty about global warming is no argument for doing nothing about it. Clearly human activity is raising global concentrations of carbon dioxide. Virtually no one seriously suggests that mankind can continue to emit increasing amounts of carbon dioxide into the atmosphere without any adverse consequences. But arguing that climate change is such an overwhelming problem that it must be stopped no matter what the cost is also untenable. A climate policy that fails to take cost into consideration will ultimately be rejected by almost all governments.

In what follows we outline an approach to climate change that differs fundamentally from that of the Kyoto Protocol yet is consistent with the 1992 UN treaty. It can be developed from current negotiations and can even be implemented by individual countries before a final international agreement is reached.

What's Wrong with Kyoto

The fundamental principle on which the Kyoto Protocol is based—setting “targets and timetables” for reducing greenhouse gas emissions—is both economically flawed and politically unrealistic. To ratify the protocol, a developed country must be willing to agree to reduce its emissions to a specified level—typically about 5 percent below the country’s emissions in 1990—by 2008 to 2012 regardless of cost. Because costs could be huge, most developed countries will never ratify the treaty or will insist, as a precondition, that their targets be diluted through an accounting adjustment that allows credit for activities that absorb carbon (called sinks). Countries that do ratify are unlikely to comply if the constraints become seriously binding. Developing nations, which will become the world’s largest emitters in coming decades, have even less incentive to sign on.

The issue of costs is crucial. The array of uncertainties associated with climate change makes it impossible to tell whether the benefits of the treaty are worth its costs. Nor is there any evidence that the targets set by the protocol are the optimal levels of greenhouse gas emissions, either for an individual country or for the world as a whole. If anything, cost-benefit calculations based on studies to date tend to suggest that the costs exceed the benefits, at least in developed countries.

Kyoto’s greatest weakness, however, is not the lack of clear cost-benefit justification. After all, governments often face uncertainty when evaluating potential policies. Because the damages caused by climate change could be very large, a prudent legislature might want to adopt a climate policy to hedge its bets as long as it could keep the policy’s costs within bounds. But Kyoto’s “targets and timetables” design makes that impossible. Governments that adopt the protocol risk taking on a disastrously expensive commitment—and surrender part of their sovereignty in the process.

The Kyoto agreement also fails to give governments any incentive to police it and lacks credible compliance measures. Monitoring polluters is expensive, and punishing violators would impose costs on domestic residents in exchange for benefits that would go largely to foreigners. Governments would be strongly tempted to look the other way when firms exceed their emissions permits. Negotiators have tried to devise a strong international mechanism to monitor compliance and penalize violations, but so far have produced only a paper tiger: the protocol’s compliance mechanism is not a credible deterrent for anything beyond very minor violations.

Nor has Kyoto found a way to include significant participation by developing countries. Because these countries are responsible for a relatively small share of historical greenhouse gas emissions, they are especially reluctant to incur large costs and give up their sovereignty in a climate change agreement. The protocol does provide a complicated mechanism that would allow developed countries to earn credits for reducing the rate of emissions growth in developing countries. However, it would have little effect overall because developing countries are expressly exempted from Kyoto’s emissions targets. They would not be required to limit their emissions unless they volunteered—at some point in the future—to accept binding emissions targets. But the protocol provides little incentive for them to do so.

A Realistic Alternative to Kyoto

We propose a pragmatic climate change policy with aims more modest than Kyoto’s. Rather than trying to cap emissions at any cost through targets and timetables, we would abate emissions where possible at low cost, using reasonable and prudent measures to reduce the risk of climate change.

In our system, as in the Kyoto Protocol, each nation would be given a fixed supply of long-term emission permits. Unlike the protocol, however, we would allow each government to supplement the supply of permits, when necessary, by selling additional short-term permits at an agreed international price. All long-term permits would be distributed by a country’s government to energy suppliers, businesses, even individuals if deemed appropriate. Each long-term permit would allow the holder to emit one ton of carbon each year. The long-term permits would be given away or auctioned or distributed by the government in any way it sees fit. Each country’s supply of long-term permits would be negotiated internationally, but one possibility would be an amount equal to 95 percent of the country’s 1990 emissions (the basis of Kyoto’s targets). That approach would “grandfather” energy producers at 95 percent of their 1990 emissions level, easing for them the coming adjustment to a world with lower greenhouse gas emissions. Once distributed, the long-term permits could be bought or sold among firms or even bought and retired by environmental groups. No additional long-term permits could be distributed, but the government could buy back permits in future years if new evidence reveals a necessity to cut emissions. The long-term permits could be perpetual, or could be issued with expiration dates—10, 20, and 50 years, for example—to give gov-

ernments more flexibility. In the latter case, each category would have its own trading market, and prices for each would emerge as they do for other asset markets.

Our system encourages energy producers to keep emissions steady or, even better, to cut them. Firms that can cut emissions cheaply will do so and then sell unneeded long-term permits to those whose emissions are increasing.

If a country's emissions increase above the level allowed by the supply of long-term permits, its government will be allowed to sell supplementary annual permits for a fixed world fee, say \$10 (U.S., 1990 dollars). At the end of each calendar year, energy producers would be required to reconcile their production of emissions with their holdings of permits. Any shortfall would require a purchase of annual permits from the government at the fixed world price.

The price of long-term permits will go up and down in response to supply and demand. The demand for permits will be determined by the cost of abating emissions. If abatement turns out to be relatively inexpensive, firms will tend to abate emissions rather than buy permits, so permit demand will also

A climate policy that fails to take cost into consideration will ultimately be rejected by almost all governments.

be low. The long-term permit price would be modest and firms would find it cheaper to buy long-term permits than to buy a corresponding string of annual permits. If abatement turns out to be expensive, permit demand will rise, as will the price of a long-term permit, and annual permits would begin to be sold. But, again, the key point is that in either case, the amount that firms spend on abatement would be capped because they would always be able to buy annual permits, if necessary, at the internationally agreed price.

Because the total supply of permits in any year would not be fixed, the policy would not guarantee precisely how much abatement will take place in that year. It would, however, ensure that any abatement would be done at minimum cost. Moreover, the pattern of abatement will be efficient across countries, as well as within each country, unless marginal costs of abatement are very low. In all countries where the price of a long-term permit rises to the fixed price cap, marginal abatement costs will be equalized. The policy also gives appropriate dynamic incentives: as long as the long-term permit price is greater than zero, firms have an incentive to investigate new methods or technologies to reduce emissions further.

The allocation of each country's long-term permits should be the subject of international negotiation, as should the fixed world price of annual permits. In view of the prevailing uncertainty, however, the initial price should be kept low. If emissions continue to rise rapidly, even after firms have had a chance to react to the policy, or if new information reveals greater risks from global warming, the price can be renegotiated, allowing the policy to evolve as more information becomes available.

Details of Trading

Countries would manage their own domestic permit trading system independently, using their own legal systems and financial institutions. International cooperation would be confined to system design and to sharing expertise.

The annual permit market would function as any normal commodity market except that an individual firm could get its permits either from the market or from the government at a predetermined world price. But, to repeat, the annual permit price is effectively fixed at the price offered by the government. The long-term permit price will vary across countries.

If new information about global warming suggests that future emission permits will be more expensive, the price of long-term permits would likely rise, signaling companies and households to change their behavior immediately rather than waiting for the world price of permits to be renegotiated. The price of the long-term permit will be the present value of the stream of expected future prices of annual emission permits. It thus acts like a futures market for carbon emission permits.

Developing Countries

The 1992 UN climate change treaty envisions all countries as ultimately contributing to reducing greenhouse gas emissions, as do we. Our blueprint commits developing countries

to participate, but caps their short-run cost at zero.

At first the allocation of long-term permits in developing countries would exceed current emissions and no annual permits would be sold. But when emissions begin to grow, annual permits would be sold, thus providing a price signal to energy producers and potential investors about the expected future price of carbon in these economies. A developing country could also use the long-term permits (which cannot be traded internationally) to encourage direct investment in low-carbon energy generation in its economy.

Monitoring and Compliance

Any market used to trade a claim over a commodity must involve monitoring, as well as real costs for failure to comply with the rules. Because the value of a long-term permit depends on the amount of emissions in an economy over time, poor monitoring of emissions will sow doubt about the true levels of emissions and decrease the value of holding a permit. The same is true of compliance. If no one complies with the requirement to hold permits to match their emissions, the value of these permits will be low if not worthless.

Under Kyoto, which allows global permit trading, poor monitoring and compliance in one country can debase the entire global trading system. In our blueprint, monitoring and compliance are decentralized to each particular economy. Some countries will be able to monitor better than others and some have better legal systems that help to impose compliance. Each system's imperfections are self-contained. In addition, the incentive to enforce the policy is internalized, both because

compliance problems would cause governments to lose revenue from the annual permit market (since they would sell fewer permits) and because holders of long-term permits will pressure their governments to be vigilant in order to maintain the market value of long-term permits.

Adapting the Policy over the Long Run

Our blueprint gives governments time to monitor how their economies adjust to the higher price of carbon and to assess the state of knowledge about climate change. If the initial fixed world price for carbon is too low, the price can be raised gradually. All parties to the UN climate change treaty should meet every decade to evaluate experience and set the new global price of carbon. Some rule for negotiating the price—for example, the concurrence of 60 percent of countries—would be needed. But, as with most of our blueprint, this issue should be the subject of international negotiation.

If new information about climate change indicates that the emissions targets used to determine the initial allocation of long-term permits are too loose, several options are available. Because the most binding constraint is the annual and not the long-term permit price, member countries could call an emergency meeting and raise the annual world price of permits. Given that the price of long-term permits is the expected future price of permits, the price of long-term permits would have already risen sharply in anticipation of the emergency meeting. If the rise in long-term permit prices were inadequate, governments might need to buy back perpetual permits to reach the higher long-run equilibrium price of carbon. Issuing long-term permits with varying expiration dates would allow some long-term permits to expire, thus encouraging consistency between the prices of annual permits and long-term permits.

How to Proceed from Here

International climate negotiations have now reached a critical juncture. The path of least resistance is to continue negotiations over implementing the Kyoto Protocol. But continuing down this path allows policymakers to defer action for years and allows emissions to grow unchecked.

Our approach would address climate change immediately in a serious, but far more practical, manner. An international policy regime like the one outlined here has many advantages over Kyoto. It would have a realistic chance of ratification in countries with large carbon emissions; it would be much less unattractive to developing countries; it could expand over time to include all countries; and it would be politically sustainable over a long period of time with existing institutions and mechanisms.

Although Kyoto's targets and timetables approach must be discarded, negotiations need not begin again from scratch. Much of the negotiating work that went into the protocol produced results that could be incorporated into an alternative agreement. For example, the Kyoto emission targets set for industrialized countries would be a natural basis for the allotment of long-term permits to those countries. Allotments of

long-term permits to developing countries would still need to be negotiated, but that could be left for the future since the policy regime would not be disrupted by future accessions. In addition, many UN climate change institutions would continue to play valuable roles, such as developing international standards and techniques for monitoring and measuring emissions, or helping countries implement the results of research. These institutions would foster the international cooperation essential for an effective climate change system to operate in the long run.

Moreover, our decentralized approach means that individual countries could begin creating domestic permit markets without waiting for a final international agreement to be negotiated. In fact, it would be in each country's own interest to do so, to allow its economy as much time as possible to adapt and to allow its financial markets to help manage the risks of climate policy. Governments could distribute their Kyoto allotment of long-term permits immediately, stipulating two things. First, emissions permits will not be required unless an international or domestic decision is made to reduce carbon emissions. Second, the permits will be honored at their face value if a carbon constraint is eventually imposed. The permits would be tradable without restriction.

Our approach does not reduce any of the deep uncertainties about climate change. Decades will pass before the risks and costs of greenhouse gas emissions are fully understood. Nor does our approach reduce uncertainty about whether emissions will eventually be regulated. It would, however, be nearly costless for governments to carry out, and it would confer a single, but critical, benefit on the economy: firms likely to be affected by climate regulations will suddenly have a new and powerful tool for managing their risk. For example, a firm that expects to have difficulty complying with a future constraint could reduce its risk by buying extra permits now as a hedge.

Of course, pricing these permits would present a short-run challenge for financial markets. What is the value of an emissions permit when it is not certain when, if ever, carbon emissions will be regulated? But that is precisely the type of problem that financial markets confront every day. How, for example, should investors respond to a firm's news about a new patent it has received on a product that has never been produced? Within a very short time, an active market would develop with prices that reflected both the likelihood of a policy taking effect and its probable stringency.

It is time to move away from the political compromises and posturing associated with the Kyoto approach to climate change policy. It is time for all countries to cooperate to implement a low-cost and effective climate change regime such as contained in our blueprint proposal. The current Kyoto Protocol—without the effective participation of the United States or developing countries, and with weak targets for those that are likely to ratify—postpones effective action by any major emitter for at least another decade and is not a prudent way to address a potentially important global problem. ■

Statehouse Greenhouse

The States Are Taking the Lead on Climate Change

By Barry G. Rabe

Washington's role in greenhouse gas reduction remains as unclear today as it was in the late 1980s, when a convergence of research and steamy summers thrust the matter of climate change onto the national agenda. Although Vice President Al Gore personally negotiated key elements of the 1997 Kyoto Protocol, the Clinton-Gore administration never seriously pursued Senate ratification of the treaty. George W. Bush entered the White House last year voicing general support for addressing climate change, but he quickly withdrew the United States from direct involvement in ongoing post-Kyoto deliberations. It took him more than a year to offer any indication of what might follow. His Valentine's Day 2002 recommendations may buy him some political cover but are at best a fig leaf, likely to have little impact on greenhouse gas releases even if approved and implemented.

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Ironically, while Washington has continued to stumble on the global warming issue, a number of states have launched constructive efforts to lower emissions of carbon dioxide, methane, and other greenhouse gases. Independently the states have passed more than three dozen laws—many during the past two years—establishing specific strategies. These strategies involve formal commitments in virtually every sector that can influence such heat-trapping gases, including electricity generation, air pollution regulation, transportation, forestry and natural resource preservation, and agriculture. The action at the state level has received remarkably little attention from environmentalists, journalists, or scholars, yet it includes elements of a new “policy architecture” for reducing effluents that the new Bush proposals ignore.

Policy for a Different Kind of Environmental Problem

International environmental agreements have a very mixed track record, particularly when it comes to implementation. In general, the more stakeholders, the greater the difficulty of monitoring and assuring compliance; the larger the economic dislocations, the greater the likely resistance to implementation. The Kyoto Protocol’s scope of intended collective action is truly stunning, making it as complex an international agreement as has ever been negotiated in any sphere of public policy.

Protocol tinkering has continued, without input from the U.S. government, most notably in 2001 meetings in Germany and Morocco. Representatives of some 165 nations are trying to carve out rules of engagement for the much smaller subset of industrialized nations that would pledge to cut greenhouse gas emissions. Alas, American disengagement has provided a visible stage for widespread denunciation of the United States. At the same time, each round of international discussion results in more deal-cutting—on everything from more favorable measurement of “carbon sinks” to reduced targets for select nations—and exposes more potential loopholes. It also remains unclear whether, even if they rat-

ify the agreement, many nations will take its implementation seriously.

Turning to the States: The Realm of the Possible

American states provide particularly fertile ground for policy innovation in climate change. First, many are quite large in terms of population, physical size, and resources devoted to environmental protection. They also spew a lot of

problem. State rules affect electricity rates, land use, waste management, and transportation. States also implement many federal environmental laws, issuing more than 90 percent of all environmental permits and conducting more than 75 percent of all enforcement actions.

Third, a growing body of scholarship suggests that far more innovation in American environmental and energy policy now emanates from the state-



harmful emissions. Indeed, if the American states were counted as sovereign nations, approximately half would rank among the top 60 national emitters of greenhouse gases around the globe. The annual carbon dioxide emissions of Texas, for example, exceed those of France. Indiana’s exceed Indonesia’s, and Georgia’s exceed Venezuela’s.

Second, states already have considerable jurisdiction over many spheres of environmental and energy policy with direct relevance to the climate change

houses than from Congress. States now dominate policy formation in pollution prevention and cross-media regulatory integration, an exigency long neglected in Washington.

State governments, of course, vary markedly in their commitment to protecting the environment. The most active states in climate change policy are those along the Pacific and Atlantic coasts, but others too are redefining policy. The leading states tend not to be dominated by one political party; in

fact, many of their most important initiatives have been enacted with bipartisan support, offering potential political lessons for federal policy. Often, affected industries have welcomed the opportunity to “claim credit” for early reductions and have not found adjustment costs particularly onerous.

Comprehensive Cuts: New Jersey

In 1998, then-governor of New Jersey, Christine Whitman (now chief of the Environmental Protection Agency) became the only North American political official obligated to implement the Kyoto Protocol. That year Whitman issued an executive order setting a goal of reducing the state’s greenhouse gases by 3.5 percent below 1990 levels by 2005. If New Jersey succeeds, it would be in line to reach the larger cuts pledged under Kyoto by decade’s end. To meet its commitment, New Jersey is using a comprehensive strategy coordinating every relevant state department or agency, from agriculture to transportation. Perhaps most noteworthy, the New Jersey Greenhouse Gas Registry facilitates intrastate crediting and trading of carbon dioxide emissions. The state expanded the registry in 1998 through a formal agreement with the Netherlands, sanctioning emission trading projects between an American state and a European nation. More recently, the state is trying to link more flexible approval of industrial permits with corporate pledges to reduce greenhouse gases.

Standards for New Plants: Oregon

Oregon has undertaken a decade-long search for ways of reducing its contributions to global warming. Its most important action derives from a series of laws signed by Democratic Governor John Kitzhaber establishing a formal standard for carbon dioxide releases from new electric power plants. Oregon has received many proposals for new facilities, particularly small- to moderate-sized plants that burn the most benign fossil fuel, natural gas. The new standard requires that carbon emissions from any new power plant proposed for operation in Oregon must be at least 17 percent below those of the most efficient

natural gas-fired plant now operating in the United States. Proposed plants may meet this standard either by developing more efficient technologies or by purchasing carbon dioxide offsets through the Oregon Climate Trust, which is empowered to pursue carbon dioxide mitigation projects. Initial Climate Trust projects include solar rural electrification, geothermal heating, reforestation, and methane reuse from coal mines and sewage treatment plants.

Standards for Established Plants: Massachusetts

Whereas Oregon has concentrated on new energy facilities, Massachusetts has focused on some of its most established—and significant—greenhouse gas sources. In April 2001, Republican Governor Jane Swift issued regulations that establish carbon dioxide caps for six power plants that collectively produce 40 percent of the state’s electricity. Each must reduce its carbon dioxide releases 10 percent below late 1990 levels by 2004–06. Options for attaining compliance include changing fuel or generating technologies, swapping carbon dioxide reduction credits with other plants in the state, or investing in off-system reductions. Several other states, including Illinois, New Hampshire, and New York, have been actively considering their own versions of this approach.

Looking Ahead

It is possible that the federal government will soon shift gears on climate change, developing a comprehensive and creative policy. It is also possible that the Chicago Cubs will reverse a near-century of futility and win the next World Series. Neither prospect seems plausible.

In the meantime the United States would be well advised to build on the best practices emerging at the state level. Congress and the executive could begin by requiring annual reporting on greenhouse gas releases and establishing formal metrics for banking and trading projects. They might also follow the lead of Massachusetts and its counterparts, expanding the “multipollutant” definition to include greenhouse gases and

emulating the most promising state reduction strategies.

It might also be desirable to link the climate change question with the question of how to divide federal and state responsibilities for environmental and energy policy. Although virtually every study on the “future of environmental policy” since the first Earth Day in 1970 has recommended finding more rational ways to allocate these responsibilities, the old hodge-podge of intergovernmental duties and tensions persists.

The Clinton administration attempted some decentralization by offering to negotiate National Environmental Performance Partnership agreements with states. The goal was to spur more innovation and measurable performance improvements by offering states greater flexibility in regulatory compliance and in spending federal grant dollars. More than 40 states participated in some fashion, although it is not clear that they or the federal government have yet devoted much energy or creativity to this process.

The Bush administration could take this tool and invite states, individually or regionally, to outline a more state-based approach to climate change policy. It could challenge groups such as the National Governors Association, Environmental Council of the States, and National Association of State Energy Officials to weave a state-based strategy on greenhouse gas reductions into a larger compact on regulatory federalism. As long as performance measures were established—and goals attained—states could receive far more latitude than under traditional regulation. They could actively engage in interstate emissions trading, possibly making expanded use of interstate compacts or even state-to-nation trading as is now being examined between New Jersey and the Netherlands as well as a cluster of New England states and Maritime provinces.

Such a devolution of leadership would, in effect, reflect the policy reality of the past decade. Tapping into the experience of the states in setting realistic climate change policy—while recognizing its current limits—might finally move us beyond the fractious debate of the past decade. ■

Three Pollutants

For the first time since 1990, Congress may be poised to enact major clean air legislation. Proposals now before Congress would affect electricity generation and large industrial facilities only and, as such, fall short of a full Clean Air Act reauthorization. But in other ways, the proposals are dramatic. They address multiple pollutants, broadly applying market-based approaches and aggregate emission caps, and would mandate deep emission cuts.

All the Congressional proposals and that of the Bush administration would address emissions of three pollutants—sulfur dioxide, nitrogen oxides, and mercury—from large stationary sources. The affected plants account for two-thirds of total U.S. emissions of sulfur dioxide, a quarter of nitrogen oxides, and a third of mercury. The proposals differ in whether they address carbon dioxide, even though the sources in question give off 40 percent of all U.S. emissions of carbon dioxide, a key greenhouse gas. Although carbon dioxide regulation is destined one day to play the leading role in clean air policy and thereby shape controls on the other three pollutants, for now it is backstage. Paradoxically, however, even from backstage carbon dioxide plays a critical role in the proposals' prospects for enactment.

The stage was set in spring of last year, when President Bush used previous clean air legislation to distinguish the three conventional pollutants from carbon dioxide. Because carbon dioxide was not identified as a pollutant in the Clean Air Act, the president termed it an "emission," not a "pollutant" and thus attempted to keep carbon dioxide out of the debate. The president's Clean Skies

Initiative, announced this past Valentine's Day, excludes mandatory controls on carbon dioxide until at least 2012. Instead, the proposal embraces the goal of simply maintaining the modest rate of reduction in the intensity of carbon emissions per dollar of gross domestic product that was achieved in the last decade. Champions in Congress are divided mostly along partisan lines. Some proposals, including most notably that of Senator James Jeffords (I-VT), have kept carbon dioxide in the script.

All the proposals would make important—and costly—cuts in emissions of sulfur dioxide, nitrogen oxides, and mercury. But costs of the proposals that include carbon dioxide go far higher—so high that they would pretty well swamp the costs of controlling the other pollutants and thereby determine the direction of investments and technological choices for the future. Including carbon dioxide in the upcoming legislation would lead industry to begin to change its choice of fuel for power production. But if carbon dioxide emissions continue unregulated, coal—which now accounts for about 51 percent of electricity production—will continue to fuel power plants at about the same level. As recent studies by the Energy Information Administration and Environmental Protection Agency show, three-pollutant legislation that excluded carbon dioxide would necessitate retrofitting coal-fired facilities with ambitious controls for the conventional pollutants, but would have little effect on coal use and carbon dioxide emissions.

Legislation that also mandates big cuts in carbon dioxide emissions, however, would require many plants to switch from coal to natural gas. The switch to natural gas, which burns more cleanly than coal, would also mean sizable cuts in the other pollutants.

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and an Emission

A Playbill for the Multipollutant Legislative Debate

By Dallas Burtraw

Will the Bush administration's proposal to leave out carbon dioxide and target only the three conventional pollutants resolve the future of carbon dioxide regulation, or will the issue be revisited? Power producers who invest hundreds of millions of dollars to comply with cuts mandated by three-pollutant legislation will not expect to see major new carbon dioxide controls just around the corner. Passing three-pollutant legislation would thus seem implicitly to commit the nation to a long-term delay in carbon dioxide policy and to an energy policy with a large coal component for many years. Indeed, for a future Congress to consider regulating carbon dioxide right on the heels of passing three-pollutant legislation could be perceived by power producers as highly unfair. Anticipating that reaction, environmental advocates may have little incentive to compromise over some pretty dicey issues involved with controls on the conventional pollutants.

A key goal of the proposed multipollutant legislation is to improve on the current regulatory framework by giving industry greater regulatory predictability and certainty about compliance requirements. Paradoxically, however, achieving such certainty, as well as taking into account the interests of industry, may require giving carbon dioxide cuts at least a small role in the multipollutant strategy.

Reducing Multipollutant Levels

Debate over the legislative proposals involves three main questions. The first is what level of control to impose for each of the three pollutants. The stakes here are high, for the leading proposals would impose large costs—several billion dollars—and reap large benefits as well. But the costs are spread roughly equally over the three pollutants.

Reducing sulfur dioxide emissions will likely yield the lion's share of quantifiable benefits. Sulfur dioxide as a gas is recognized as a potent health threat, but it is more noteworthy in economic terms for its role in forming secondary particulates and acidifying soil and water.

In the public policy world, sulfur dioxide hit marquee status with passage of the 1990 Clean Air Act Amendments, which mandated a 50 percent cut in aggregate emissions from electricity generation. At the time, Paul Portney, of Resources for the Future (RFF)—the only analyst bold enough to offer an estimate of the benefits and costs of the amendments—predicted that benefits of sulfur dioxide cuts would about justify the costs. Subsequent analysis by the EPA and RFF suggests that two unexpected developments caused benefits to exceed costs by far. First, since 1990, a cascade of new research—most recently, a study published in the *Journal of the American Medical Association* early in March—has linked secondary particulates from sulfur dioxide emissions with premature mortality, raising the quantifiable economic benefits of sulfur dioxide cuts many times over what was expected. Second, cutting sulfur dioxide proved less costly than anticipated.

In 1990, although the primary benefits were ultimately found to stem from improvements in health, arguably the main justification for the sulfur dioxide cuts was acid rain. Since 1990, sulfur deposition in sensitive ecological areas has fallen dramatically, but recovery has been slower than expected, leading many advocates in the northeast to call for further sulfur dioxide cuts of as much as 75 percent. Meeting that target will mean more than simply switching to low-sulfur coal at more facilities. Compliance will require the widespread installation of scrubbers—and

benefit-cost perspective, the proposed sulfur dioxide cut is an easy pill to swallow.

Nitrogen Oxides

Pending multipollutant proposals would reduce nitrogen oxides from electricity generation to some 50–75 percent of current baseline emissions. The cuts have multifaceted and important benefits but are harder to justify on a cost-benefit basis than the cuts in sulfur dioxide.

Nitrogen oxides have effects similar to those of sulfur dioxide. They contribute to secondary particulates but are usually thought to be less potent in affecting health. They are also instrumental in acidification, but again most analyses attribute to them a lesser role. Both pollutants impair visibility. Nitrogen oxides also contribute to forming ground-level ozone, another pollutant identified in the Clean Air Act, but health scientists and economists assign lower benefits to reducing ozone than to reducing particulates.

The 1990 Clean Air Act Amendments first imposed modest cuts in nitrogen oxides emissions at power plants. In complying with the 1990 law, plants have already made the least expensive cuts. Dramatic further reductions will require widespread installation of post-combustion controls (mostly, selective catalytic reduction) and will be quite costly.

In sum, viewed from the basis of each ton reduced, the benefits of cutting nitrogen oxides appear to be equal to (or perhaps a little less than) those of cutting sulfur dioxide. But the cost per ton of the nitrogen oxide reductions is greater than the cost per ton of cutting sulfur dioxide. Thus, benefit-cost considerations would argue for greater relative reductions in sulfur dioxide—at least as long as they continue to yield the biggest bang for the buck. But current proposals would reduce the emissions of both by equal percentages.

Mercury Levels

Proposed mercury cuts are even larger, in percentage terms, than cuts in the other two pollutants. Though highly toxic and with potentially profound ecological and human health effects, mercury is emitted in much smaller quantities. And the benefits of reducing mercury emissions are hard to quantify. The Clean Air Act would normally require maximum achievable emission reduction for mercury as a hazardous air pollutant, leading to more than 90 percent removal, but the 1990 amendments gave mercury a temporary special exception. Mercury may, however, come under strict control in the next few years within the existing regulatory process unless exempted by legislation or blocked by litigation. Whichever ending is played out—implementation or exemption—will determine the baseline against which the multipollutant legislative proposals are measured. Environmental advocates seem to expect a baseline that reflects tightening controls on mercury. Realistically, however, long delays in implementing mercury controls on electricity generation are likely unless multipollutant legislation is passed.

from various small sources through pollution prevention—for example, by placing a declining cap on the use of mercury in products and process—would be far less costly than controlling mercury emitted in power production. That would argue for pursuing other, less costly options before pushing far in the power sector.

Furthermore, installing post-combustion controls for sulfur dioxide and nitrogen oxides would yield sizable ancillary reductions in mercury. Selective catalytic reduction controls for nitrogen oxides oxidize much of the available mercury, and sulfur dioxide scrubbers capture the oxidized mercury. Although technical experience is limited and prediction is thus uncertain, simultaneous controls for sulfur dioxide and nitrogen oxides probably cut more than half of mercury emissions. Making greater cuts would require installing new technologies, such as activated carbon injection, that are as yet unproven in widescale application. Their cost is especially high when viewed in marginal cost terms, because the incremental reductions (those over and above the ancillary benefits of sulfur dioxide and nitrogen oxides controls) are small.

In sum, moderate mercury emissions cuts are available as part of a multipollutant strategy that targets sulfur dioxide and

A key question in the multipollutant

nitrogen oxides comprehensively, and these cuts are reflected in the administration's proposal. Making further modest cuts would encourage development of new technologies, but the dramatic reduction targets for mercury controls embedded in Jeffords' legislative proposals come at a high cost.

New Source Review

A second question in the debate over multipollutant legislation is whether to revise requirements for the New Source Review (NSR) program, originally established by the 1977 Clean Air Act and now under scrutiny by the Bush administration. The program requires sources that add or modify equipment that could generate new emissions to use new technology to cut emissions. New source performance standards characterize allowable emission rates for either modified or new sources anywhere in the nation. Sources that increase emissions in areas of the country that do not meet federal air quality standards are held to even stricter emission levels and must cut emissions in other facilities to offset new emissions. To some, NSR appears to be a bargaining chip in the debate; to others it is the central issue.

The NSR program's biggest problem is uncertainty. A firm that modifies a source does not know whether it will trigger NSR requirements and what those requirements might be until a determination is made by the EPA. The technologies that are acceptable in areas that do not meet federal standards are subject to change.

Differences in emission standards between facilities under

on pollution control. In addition, firms under NSR may try to avoid expense and uncertainty by delaying investments to modernize facilities. And new sources in areas that do not require emission offsets increase emissions in the aggregate.

Advocates vigorously defend NSR, arguing that it has led to dramatic emission cuts and that it identifies new technologies and innovations and brings them to application. But a key goal of the legislative debate must be to streamline and increase the predictability of the NSR process as it applies to electricity generation.

Design

During the mid-1990s Washington sharply revised its view of market-based approaches to environmental regulation. After years of suspicion, the default question is now: why not use market-based approaches? All the pending multipollutant proposals would regulate sulfur dioxide and nitrogen oxides within an emission allowance trading program based on the trading program established in the 1990 Clean Air Act Amendments. But how the trading programs are designed and whether mercury is included are major issues still in play.

The existing regional cap and trading program for nitrogen

when allowances are allocated at zero cost. And prices for consumers may go higher than is justified by producer costs. When a similar scenario unfolded as industry complied with the 1987 Montreal Protocol to protect stratospheric ozone, Congress captured the "windfall profits" by taxing them. The same thing may happen here.

Looking Ahead

Compromise would enhance the cost-effectiveness of the multipollutant legislation and, at least from the view in the balcony seats, increase its chance of passage. Sulfur dioxide reductions of the size being proposed have apparent justification, but the nitrogen oxide reductions proposed for the entire nation are hard to justify economically and in any case face political opposition in the western states. A compelling alternative would be to transform the seasonal program in the 19 eastern states into an annual one and to impose somewhat less stringent controls in the other states. The case for maximum reductions in mercury emissions is the weakest. A better strategy would be to claim the mercury reductions that are achieved ancillary to imposed reductions on sulfur dioxides and nitrogen oxides as a victory. In fact, this approach may

Legislative debate is what role to give to limiting carbon dioxide emissions.

oxides operates during the five-month summer ozone season in 11 northeastern states. It will be expanded to a 19-state program in 2004. Current three-pollutant proposals would make the program national and year-round. Recent research suggests that operating the program year-round in the 19-state region would improve its cost-effectiveness dramatically. But expanding it nationwide is harder to justify because population density is much less, and consequently the aggregate benefits of reducing exposure to pollution are much less. It would also lead to a divergence in the distribution of benefits and costs across the nation that could be its undoing in Congress.

It remains to be seen whether mercury would be regulated through trading or through inflexible technology standards. Textbook treatment of pollution implies that the marginal costs of control among facilities converge as emission reduction targets approach 100 percent, because essentially every facility has to eliminate the emission. But Alex Farrell of Carnegie Mellon University has demonstrated that the marginal costs of mercury control among facilities fan out widely as controls approach 100 percent because of differences in coal types and in the other pollution controls that are in place. That argues for a trading program, which would be a departure from the usual controls on hazardous air pollutants.

One other design issue is a sleeper, but its importance will surface soon enough. How tradable emission allowances are allocated portends potentially large transfers of wealth and affects total costs as well. Because of expanded competition in the electricity industry, the value of the emission allowances may far outstrip the cost of compliance for power producers

provide a justification for the cost-effectiveness of nationwide nitrogen oxide controls that is missing if those controls come on top of controls on mercury (and vice versa). One could also question whether the NSR program needs to exist at all if stringent caps are placed on emissions. But unless those caps decline continuously over time, the NSR program will be essential from the perspective of environmentalists.

The administration's proposal embodies many of these suggestions with respect to levels of control (72 percent reduction for sulfur dioxide and 67 percent reduction for nitrogen oxides). It goes most of the way to meeting the Jeffords proposal with respect to sulfur dioxide and nitrogen oxides (75 percent reductions for both pollutants), but calls for mercury reductions that would be mostly ancillary to these (69 percent) rather than the maximum achievable (90 percent). The big difference between the proposals is timing. The Jeffords proposal would achieve these reductions a decade sooner than does the administration plan. Given the maturity of control technologies, the shorter timeline is practical and preferable.

The most important consideration, however, is what role is given to limiting carbon dioxide emissions. Large cuts do not appear plausible, but zero reductions do nothing to resolve the most important environmental uncertainty facing the electricity industry. A policy of modest cuts, beginning now and implemented through market-based policies, would stabilize the setting for new investment, provide incentive for innovation in technologies and institutions, and provide the opportunity to learn about the costs of climate change policy.

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Is Sunshine the Best Disinfectant?

By Mary Graham

The Promise and Problems of Environmental Disclosure

Last year the U.S. Environmental Protection Agency reported the continuation of a remarkable trend. Releases of toxic chemicals into the environment had declined by 46 percent from 1988 to 1999, even as the economy was growing rapidly. The decline was attributed not to new federal rules and strict penalties, however, but to a newly prominent form of environmental regulation: government-required disclosure of information about environmental risks.

In 1986 Congress passed a new law requiring manufacturers to reveal to the public their toxic releases in standardized form, chemical by chemical and factory by factory. By 1997, the EPA was referring to that disclosure system as one of the most effective environmental requirements ever. During the late 1980s and 1990s, Congress and state legislatures added dozens of other disclosure requirements aimed at improving environmental protection. Traditionally viewed as an underpinning for government standard-setting or enforcement actions, information itself became a regulatory mechanism.

Reducing Risk by Requiring Disclosure

The idea that government-required disclosure can reduce risks is not new in American public policy. In 1933 and 1934, newly elected President Franklin D. Roosevelt championed the approval of the Securities and Exchange Acts, which required companies that sold securities to the public to reveal earnings, obligations, and other data to reduce financial risks to investors. Over time, those disclosure requirements formed the basis for public confidence in the nation's securities markets.

Many parallels exist between those laws and newer systems of environmental disclosure. Both rely on mandatory disclosure of factual information, standardized reporting at regular intervals, and identification of companies, facilities, or products that are the sources of risks. Both are based on the premise that public access to information will strengthen market incentives or political pressures for organizations to minimize risks. Both draw on the idea of Louis D. Brandeis, known as the “people’s

attorney” for his battles against predatory practices of big business, that “[p]ublicity is justly commended as a remedy for social and industrial diseases. Sunlight is said to be the best of disinfectants.”

Now, in the wake of the bankruptcy of Enron, Inc., Congress, regulators, and investors are taking a closer look at how financial disclosure works in practice. Mounting evidence suggests that rules can become outdated and managers can manipulate information to deceive rather than inform the investing public. A closer look at the nation's newly prominent systems of environmental disclosure also raises cause for concern. Like other forms of regulation, it turns out, disclosure systems can employ flawed metrics, provide a partial picture of reality, or lack the resources for effective enforcement.

Reducing Environmental Risks

In recent years, Congress and state legislatures have constructed disclosure systems to reduce some of the environmental risks the public fears most, often in response to highly publicized incidents. Congress required manufacturers to reveal their toxic releases after a disastrous chemical leak at a pesticide plant in Bhopal, India, in 1984 killed more than 2,000 people. New Jersey, Massachusetts, California, and other states created even broader systems of disclosure. Congress required local water authorities to send their customers annual accounts of detectable contaminants in drinking water after cryptosporidium invaded Milwaukee's water supply in 1993 and sent 4,400 people to the hospital. Congress required standardized labeling of organic produce amid persistent public concern about pesticide residues in food. Other environmental disclosure systems responded to public fears by providing buyers and renters access to information about hazards from lead-based paint and giving employees access to data about health and safety risks on the job.

These disclosure systems represent a third wave in modern environmental regulation. During the 1960s and 1970s, an era of confidence in government's capacity to influence business practices with rules, new laws called for minimum standards for design or performance. During the 1980s, a decade of par-

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ticular confidence in market mechanisms, legislation called for taxes, subsidies, or trading systems to provide economic incentives for improvement. Since the late 1980s, as concern about market flaws caused by information gaps and faith in information technology have grown, new laws have emphasized public access to information.

While such disclosure measures have developed most prominently in the United States, important future applications may be international. Indonesia, the Philippines, and other developing countries have begun to adopt disclosure systems to encourage pollution control. International organizations have used disclosure to improve environmental practices when sanctions have proven infeasible. Unlike standards, taxes, or subsidies, the influence of information is not constrained by national boundaries.

Politics and Compromise

Like other forms of regulation, however, disclosure systems are inevitably the product of political compromise. The value of public access to information has often clashed with the value of protecting trade secrets or minimizing regulatory burdens. The architecture of disclosure has sometimes been skewed to give more weight to narrow, short-term interests than to broad, enduring priorities. The requirement that the public be informed about manufacturers' toxic releases, for example, did not extend to releases from cars, trucks, buses, and small businesses, the largest sources of toxic air pollution. To ease the burden on targeted manufacturers and thereby enlist their support, Congress allowed companies to base disclosure on estimates rather than on new monitoring and adopted procedures that provided the public with information that was more than a year out of date. Nor did Congress require any calibration of exposure or chemical toxicity, meaning that levels of risk were impossible to discern. Many toxic chemicals were omitted from the government's initial list, so substitutions might increase rather than decrease hazards. And EPA was never given the resources to assure that reporting was accurate or complete.

These problems are not unique. Public access to data about detectable contaminants in drinking water also allowed disclosure to be based on whatever information water authorities had on hand. The fact that data could be months or years old meant that customers with compromised immune systems could not discern whether the water they were drinking included contaminants they should avoid. Congress also heeded state demands for discretion in designing contaminant reports, thereby compromising consumers' ability to compare the track records of different systems. OSHA's hazard communication system relied on data sheets and labels of varying quality and completeness. In all these systems, the truncated scope of disclosure may have led companies to take resources from activities that would have produced larger reductions in environmental risks to devote them to minimizing reported events.

Lessons Learned

The issue now is whether designers of future disclosure sys-

tems will draw lessons from the early applications of environmental disclosure and improve on this potentially powerful regulatory tool.

The most formidable obstacle to its effective use is the paucity of risk indicators that can claim broad consensus. The current metric for toxic pollution (total pounds of releases) fails to account for toxicity and exposure. But any measure of toxic risk today would be politically controversial and scientifically debatable. Giving people useful information about risks associated with contaminants in drinking water is similarly problematic. Any effort to use disclosure as a regulatory device should include an initial judgment of whether its metrics are good enough to inform rather than deceive the public and how to improve them.

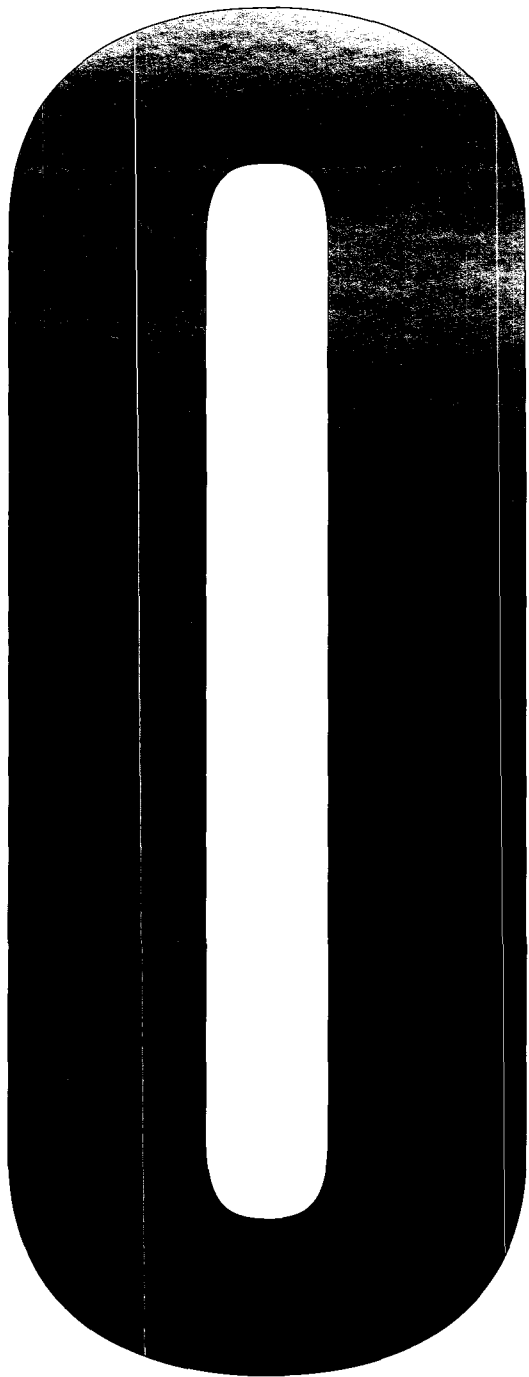
The potential effectiveness of disclosure requirements, like that of other forms of regulation, can also be impaired if their scope is too narrow. If they are successful, such requirements create incentives for target organizations to reduce risks that are reported. But corporate responses can result in an overall increase in hazards or channel too many resources to reducing relatively minor problems if disclosure is not matched to the dimensions of risk in question. The disclosure system for toxic releases encouraged managers to replace listed chemicals with off-list substitutes, even if they were more toxic. It also rewarded large reductions of relatively safe chemicals more than small reductions of extremely hazardous chemicals. Designers of disclosure systems will increase chances of effectiveness by examining with care the boundaries of the risks they seek to reduce.

In addition, disclosure systems require analysis and feedback about how well they are meeting intended objectives. Like other regulations, they can create incentives that do not keep pace with changes in public priorities, scientific knowledge, and markets.

Finally, effective communication is no simple matter. It can be complicated by the cognitive shortcuts that people use to understand risks and by self-serving manipulation of data by self-interested intermediaries. Recent research by psychologists and economists suggests that people tend to overestimate rare but catastrophic risks and underestimate risks from frequent but less dramatic events. People also attach disproportionate importance to risks of events that are easily brought to mind, ignore evidence that contradicts current beliefs, and tune out when confronted with information overload. Learning more about such distortions can enable honest brokers to improve communication.

The emergence of environmental regulation by disclosure holds promise. It represents a constructive adaptation of the American political system to changing times and changing needs. Used wisely, it can improve market mechanisms, enhance public choice, and reduce environmental risks. Designed haphazardly, it can impair markets and set obstacles in the way of pursuing public priorities. No leaps in information technology can assure that accurate and complete disclosure will triumph over the politics of the moment. That is a matter of political will. ■

International

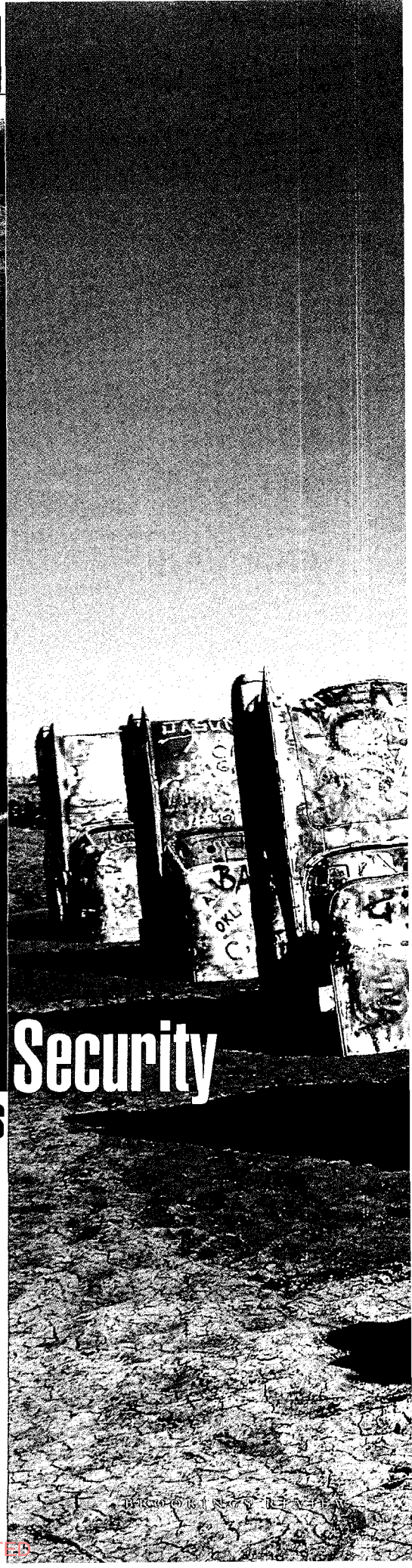


Problems and Policies

The reemergence of concern about energy security in the wake of the September 2001 terror attacks amplified a theme that was already present in U.S. energy policy debates. World oil prices rose from about \$10 a barrel in 1998 to more than \$30 a barrel in late 2000, though they have since fallen below \$20 a barrel. In 2000 the United States imported almost 60 percent of the petroleum it consumed; imports from the Organization of Petroleum Exporting Countries (OPEC) made up about a quarter of total U.S. consumption. Energy security was a central theme in the Bush administration's energy policy report released by Vice President Cheney in the spring of 2001.

Michael A. Toman is a senior fellow at Resources for the Future.

Security





By Michael A. Toman

All kinds of policy goals have been advanced in the name of oil security. They range from drastic increases in motor vehicle fuel economy to more funding for wind energy to drilling in the Alaskan National Wildlife Refuge to jawboning Mexico to increase supplies and eschew cooperation with OPEC. Some of the proposals—in particular the notion of eliminating oil imports—have been plain silly. Almost all suffer from an apparent misunderstanding of the oil security problem—and the often contrasting policy implications of its different components. (Those of us who lived through similar debates in the late 1970s and early 1980s feel an alarming sense of *déjà vu* in all this; the half-life of common sense about energy policy apparently is fairly short.)

The Basics of Oil Security

The international oil security problem has two components. The first is the exercise of market power by international oil exporters to raise petroleum prices. For much of the 20th century the United States maintained a tariff on oil imports to protect its petroleum industry against lower-priced competition from abroad. By the early 1970s, concern had shifted to the ability of OPEC to restrict supplies and raise prices. While beneficial to U.S. oil producers, higher prices raise the real cost of domestic and imported oil for U.S. businesses and households, thereby crowding out other opportunities for consumption and saving.

The second component is macroeconomic disruptions arising from oil price instability. These disruptions became a concern during the 1970s, when oil price shocks were followed by economic downturns and inflation in the industrialized countries. Among the causes of oil price shocks are unexpected supply reductions by individual oil suppliers or suppliers as a group, unexpected surges in demand (caused, for example, by a cold winter), or destabilizing inventory adjustments (such as a build-up of stocks when the market already is tight). Oil price shocks appear to have consequences for the economy beyond the direct effects of an increase in energy costs.

Researchers have offered varied explanations for this multiplier effect. Energy price shocks could increase unemployment because worker productivity drops when energy use is curtailed in the face of rising prices and real wages do not fall along with productivity. A sharp and sustained increase in energy prices could idle fixed capital or make it prematurely obsolescent. The economy as a whole could experience adjustment costs as producers and consumers try to respond to the energy price hikes by altering the bundles of goods and services they make and buy. The direct and indirect burdens of higher energy prices are likely to be heaviest for lower-income groups.

The key issue in global oil security is not “running

DANNY LEHMAN/CORBIS

out”—the world has hundreds of years of existing and potential reserves. Nor is it targeted embargoes or how much oil the United States buys from particular countries—both are meaningless in an integrated world oil market. The key issue is energy prices.

OPEC and Oil Security

Beginning in the late 1990s, political and economic analysts pointed to what appeared to be a confident and resurgent OPEC ready to assume control of the world oil market. As causes, they cited a more cooperative leadership in Venezuela and (more recently) in non-OPEC Mexico, diminishing discord between Saudi Arabia and Iran, and the formal adoption of a target price band (\$22–28 a barrel) that made OPEC’s oil production targeting seem more technocratic and less political.

Adam Smith would never see the current world oil market as a textbook example of perfect competition. In principle, OPEC should be able to exercise considerable market power given its large share of global production (around 40 percent, with a somewhat higher share of world production capacity). But reports of OPEC’s ascendancy may be premature. As noted, oil prices have fallen over the past year, and there is now talk of lowering the target price band. While the economic downturn and softening of world oil demand are partly responsible, OPEC’s difficulty in coping with these developments is telling. Moreover, just as the North Sea and a resurgent industry in North America during the 1970s stemmed OPEC’s ability to keep prices high, today Russia is raising its oil output. Other areas of the former Soviet Union around the Caspian Sea offer additional possibilities for expanded non-OPEC production in the future.

In the longer term, OPEC could be in a stronger position to exercise substantial market power. It controls around three-quarters of the world’s known oil reserves, and the U.S. Energy Information Administration projects that its share of world output could rise to 50 percent by 2020. Recent technical strides in oil recovery and discoveries of

new oil reserves elsewhere are unlikely to reverse this state of affairs. And while the technological advances that have helped stabilize U.S. domestic output should continue to unfold, the United States will inevitably become more dependent on imports over the long haul. But the way to forestall stronger OPEC market dominance is not to be found in today’s renewed calls for “energy independence.”

The Costs of Market Volatility

Neither the demand for oil nor its supply is highly price sensitive in the short term. When supplies go down, prices have to rise considerably to adjust demand. No matter who produces the oil, a shock to global supplies (accidental or deliberate) will send oil prices up abruptly. While price shocks are uncomfortable, they are not likely to be severe or to last long. (There could be exceptions, such as losing Saudi Arabia’s entire output for five years.) Moreover, fairly large swings in petroleum prices seem to have become business as usual in an inherently volatile market. How serious, then, are the macroeconomic threats posed by oil price volatility?

A great deal of research finds that oil price jumps are linked empirically to slumps in macroeconomic performance, and that link is a legitimate concern for public policy. While individual oil buyers and sellers will have reason to hedge their own financial risks (buying more fuel-efficient equipment, holding inventories, hedging on the futures markets), they will not take into account the economy-wide stakes in the oil-intensity or broader energy-intensity of economic activity.

But many questions about the effects of oil shocks remain unanswered. How, exactly, do households and businesses respond to energy market disturbances? If an energy price shock is likely to be short-lived, why would it necessarily be so disruptive? Does the continued slow decline in the oil- and energy-intensity of the U.S. economy help explain why the link between energy prices and the economy seems to be getting somewhat weaker?

Notwithstanding the empirical uncertainty, three key points stand out.

First, the vulnerability of the U.S. economy to oil price shocks depends on the intensity of petroleum consumption here and throughout the industrialized world, not on total U.S. imports or imports from the Middle East. Even if we could raise domestic output or reduce demand tomorrow to eliminate imports, a shock in world oil markets would still raise domestic prices and harm the economy because U.S. petroleum suppliers would charge the same price as other suppliers. The same is true if we could reduce our imports of more “insecure” oil and rely (as we already do) primarily on “safer” import sources: a shock anywhere in the world will be felt throughout an integrated world oil market.

Second, the economic cost of eliminating oil imports either by increasing domestic supplies or by reducing energy consumption would be enormous. The necessary domestic supply increases would be costly because the United States has depleted most of its low-cost reserves. The problem on the demand side is illustrated by a recent National Research Council report on how much vehicle fuel efficiency could be increased at a modest cost. Even the most optimistic perspectives in this report imply a huge cost to eliminate U.S. dependence on foreign oil.

Third, it is misleading to attribute the costly U.S. presence in the Middle East solely to the nation’s high degree of oil dependence and to argue that import reductions could significantly reduce the costs of Middle East involvement. As noted, materially reducing U.S. oil imports would be extremely costly—and the rest of the industrialized world would remain highly dependent on uncertain Middle East oil supplies. Moreover, the U.S. presence in the Middle East serves ends beyond oil security. Reducing U.S. oil imports would do little to lessen this presence.

Policy Implications

The Bush administration favors increasing domestic energy production to reduce dependence on foreign oil, along with some limited efforts to expand energy efficiency and alternative energy

resources. Following the release of the administration's plan, legislation was introduced in the House of Representatives to offer new tax breaks for domestic energy, including petroleum, and to open the Alaskan National Wildlife Refuge to oil exploration and production. Critics of the plan argue against ANWR drilling and for greater efforts to improve energy efficiency (in particular, vehicle efficiency), as well as to develop and expand the long-term use of domestic renewables.

Understanding the logic of the international oil security problem helps one sort through this welter of conflicting proposals. As noted, increasing U.S. domestic petroleum output will do relatively little to enhance energy security. A big increase in U.S. output could heighten competition for OPEC in the short to medium term, thereby moderating oil prices somewhat. But U.S. oil production is simply too high-cost (and reserves too limited) for increases in domestic output to affect OPEC much, especially over the long haul. Moreover, while increased U.S. output might fractionally reduce the probability and severity of disturbances in the world oil market, it will also increase vulnerability to the extent that it helps keep prices down and discourages longer-term reductions in the oil-intensity of overall economic activity. Again, the problem is total consumption relative to economic activity, not import dependence or sources of imports. Finally, the social cost of expanding domestic supplies by developing higher-cost resources and granting more indirect subsidies is likely to be considerable.

A corollary of this reasoning is that the energy security argument for drilling in ANWR is at best weak. Opening up ANWR can be debated on economic and environmental grounds (that is, the oil assets in ANWR have a social value if exploited, but so does preserving environmental conditions there). Output from ANWR could increase competition for OPEC in the medium term. But OPEC already faces and will continue to face competition from increases in other non-OPEC oil supplies, and the strength of OPEC's market power remains open

to debate. And increased ANWR output will fractionally reduce U.S. energy security by helping to maintain a more oil-dependent economic system.

The key to increasing U.S. energy security, from a macroeconomic perspective, is reducing the petroleum intensity of economic activity. Hot debate continues over how cost-effective conservation might be. The National Research Council study of vehicle fuel economy concluded that energy security benefits might be worth between 2 cents and 24 cents a gallon of gasoline, with a "best guess" of 12 cents. (My own view is more conservative.) Embedding these values in petroleum prices by, for example, a gasoline tax would only fractionally increase energy efficiency, though the increase would grow over time as vehicle purchases adjusted. And even if optimists are right about the low cost of regulated increases in fuel economy, these increases would come nowhere near eliminating exposure to macroeconomic adjustment costs.

While conservation and energy efficiency improvements can help enhance energy security, a more robust policy program would include other measures. In the shorter term, the government must figure out how to use the Strategic Petroleum Reserve more effectively. The Bush administration has restated the old and misguided view that the roughly 550-million-barrel reserve should be used only for some undefined "emergency," not as a way of altering market prices. But if the energy security problem is fundamentally related to jumps in energy prices, should not moderating those prices be a central policy goal? In the past some analysts have called for treating the reserve as a publicly provided source of supplemental supply that the private sector can bid for through options contracts like those that already exist in commodity exchanges. That approach needs to be dusted off and seriously considered,

together with a small excise tax on all petroleum consumption to pay for operating the reserve. Otherwise the reserve should be emptied and the funds from its sale devoted to more worthwhile purposes. Along with a better plan for managing the reserve, policymakers need to consider additional ways to reduce energy supply bottlenecks (like constraints on natural gas pipeline capacity) and to cost-effectively protect low-income groups from the full brunt of energy price jumps.

Over the longer term, affordable energy security will come mainly from increasing the diversity of energy sources and making energy consumption more responsive to price changes. One approach would be to expand the use of vehicles that use both gasoline and other fuels. Even better, for the long

term, may be moving toward highly efficient and (eventually) non-fossil-based energy systems like hydrogen fuel cells. Unfortunately, most of the highly desirable new energy systems probably are still years (or even decades) away from large-scale commercial adoption. That may not be too long to

wait if one views the energy security problem as manageable in the short term through the Strategic Petroleum Reserve and other measures, including unavoidable diplomatic and military efforts to protect oil supplies. Accelerating the pace of energy diversification would mean more public spending on a much more concerted effort to overcome technical hurdles. It would also require a change in the economic condition of energy markets—in which low fossil fuel prices make advanced technology development and diffusion unprofitable. We can get as much energy security as we are willing to pay for through a combination of higher current energy prices and increased R&D efforts. But we cannot get something for nothing, at the end of a drill bit or otherwise. ■

The key issue in global oil security is not "running out." It is energy prices.

ENERGY

Integrating the North American Energy Market

By Pietro S. Nivola

“Let us set as our national goal,” President Richard Nixon proclaimed more than a quarter-century ago, “that by the end of this decade we will have developed the potential to meet our own energy needs without depending on any foreign sources.”

Although President George W. Bush’s energy plan is a lot less utopian, and indeed has certain merits, one of its suppositions, too, seems to be that Americans will be better off if they reduce “reliance on foreign energy.” During the 2000 election campaign, the Bush camp rhapsodized about bygone days when “one of America’s greatest strengths was its energy self-sufficiency.” The theme has since been reiterated frequently, for the United States now produces at home less than half the oil it uses. In the words of the House majority whip, Tom DeLay, “America faces a serious degradation of our national security unless we move at once to reduce our dependence on foreign sources of energy.” (Which “foreign sources of energy”? Presumably, we are not debating inflows from friendly places like Canada and Mexico. But hold on; I will return to that subject shortly.)

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Cobbling at Home

For all its persistent political fascination, the self-sufficiency logic is fundamentally flawed. In 1973 the United States imported little more than a third of the petroleum it consumed. Yet the U.S. economy then proved far more, not less, exposed to the shock of rising international oil prices than it was two years ago when those prices soared again while our dependence on foreign oil reached an all-time high. The extent of a nation's vulnerability, in other words, is not a function of how much energy it produces domestically or buys from abroad. Britain, for instance, produces more oil than it needs. But its self-sufficiency scarcely shielded British consumers from the sudden spike in gasoline prices in the summer of 2000. The reason is simple. Petroleum prices every-

It is wasteful to insist on making at home those commodities that can usually be supplied more cheaply from somewhere else—just as it makes no sense for me to cobble my own shoes instead of “importing” them from a shoe store. Funneling scarce resources into enterprises in which we no longer have a comparative advantage means leaving less capital and labor available to other industries—ones that could put those resources to better use. Society's living standards are lowered, not secured, by the pursuit of autarky.

Prudent Policy

All this is not to say that no additional reserves of oil are worth recovering within U.S. territory. Wherever feasible, they should be found and used. Adding their output to the world's

or Interdependence?

where are set in a world market—and no country, even a net exporter, can readily repair to an energy policy that says, in effect, “Stop the world. I want to get off.”

More consequential for economic stability than the share of fuel supplied by foreign sources is a nation's relative energy-intensity and susceptibility to inflationary pressures. To produce a dollar of GDP, America today requires about 30 percent less energy than it did 30 years ago. So our economy now is less vulnerable to the effects of energy price increases. The economy is also far less inflation prone than it was in the 1970s. Consequently, even the tripling of global crude-oil prices between 1998 and 2000 did little damage.

Although you might not know it from listening to the rhetoric in Washington, this country still produces all but about a quarter of the “energy” it needs. Yes, imports of oil have increased (mostly because Americans choose to drive far more, and use much less efficient motor vehicles, than do consumers in other industrial countries), but imported oil is just one part of the picture. Nearly all of what propels the nation's electric generators—coal, gas, nuclear power, hydropower, and non-hydro renewables—is domestically produced. About 85 percent of our primary heating fuel, natural gas, is made in the U.S.A. (almost all the rest comes from Canada).

The quest for ever-greater energy independence was fanciful in Nixon's time and would be no less quixotic today. The days when the United States was a low-cost producer of oil are history. Squeezing additional supplies from the remaining domestic reserves will require increasingly elaborate operations, many of which may be prohibitively expensive if proper environmental safeguards are factored in and if world prices sag, as they have repeatedly in the past 15 years. In a free market, it is hard to see how such projects can compete with various foreign sources where production costs are lower. Most of the oil extracted by the Organization of Petroleum Exporting Countries (OPEC) costs less than \$5 a barrel to produce.

supply is desirable, just as it is worthwhile to get more from any industry that can competitively make products the world needs.

Nor do I mean to suggest that a disruption of the global oil supply would no longer have an adverse impact on the U.S. economy. Suppose that another crisis in the Middle East were to take a large volume of oil—say, 7 million barrels a day (mbd)—off the market. Suppose, also, that after drawing down perhaps 2.5 mbd from strategic petroleum reserves no other sources were available to make up for the shortage. Brookings economist George L. Perry estimates that the world price of crude could hit \$75 a barrel. An increase that big could add as much as 5 percentage points to inflation and would promptly deepen the recession throughout the industrialized world.

Clearly, building up emergency stockpiles in the industrial countries is the first line of defense against such a disruption. Having access to spare production capacity outside the disrupted fields is also helpful. If the strategic reserves contribute 2.5 mbd and the extra capacity could add 1 mbd, a potential 7 mbd loss would be reduced by half. Under these circumstances, according to Perry, the price of oil would go to only \$32 a barrel, so that regular gasoline would cost roughly \$1.75 a gallon—a change well within the range of price variation in recent years. But notice: the surge capacity is a global, not a national, imperative. As long as it is available somewhere amid the earth's extensive assortment of reliable producing areas, much of the global shortfall (and the price shock for American consumers) will be offset.

Some of this cushion already exists. The supply side of the international petroleum market today is a lot more diversified than it was in the dark days of 1973, when the Arab oil embargo wrought havoc. The share of oil the United States buys from the Persian Gulf now represents less than a quarter of U.S. oil imports, down from almost 30 percent in 1980. Fully half of the oil we import comes from within the Western

hemisphere. A number of large suppliers, outside OPEC as well as within it, are not operating at full capacity. If past is prelude, they would almost certainly put more oil on line amid the high prices of a tight market.

To gain additional insurance in an economically efficient fashion over the longer haul, policymakers should enhance trade relations with the stable suppliers that have abundant energy resources. Conveniently, at least two of them happen to be in the immediate vicinity. President Bush, to his credit, has spoken of the “need to recognize the energy potential of our neighbors, Canada and Mexico.”

Opportunities in North America

The United States is the world's second largest producer of oil, Mexico the eighth. But with proved reserves around 23 percent larger than those of the United States, Mexico holds considerable promise for increased production. The same goes for our northern neighbor. No country, not even Saudi Arabia, exports more oil to the United States than does Canada. In the years ahead, Canada is likely to make a larger contribution as much more output from recent discoveries, such as Newfoundland's enormous Hibernia Field, comes on stream. The bulk of Canada's hydrocarbon resource base is still unrecoverable at current prices and with existing technology, but it is potentially immense. Alberta's oil sands, for instance, might contain the equivalent of an estimated 300 billion barrels of oil, more than all of Saudi Arabia's proven reserves. To put matters in perspective, if eventually even just one-quarter of this source were to become available, it would meet all the combined demand of both countries for nearly a decade (at current rates of consumption).

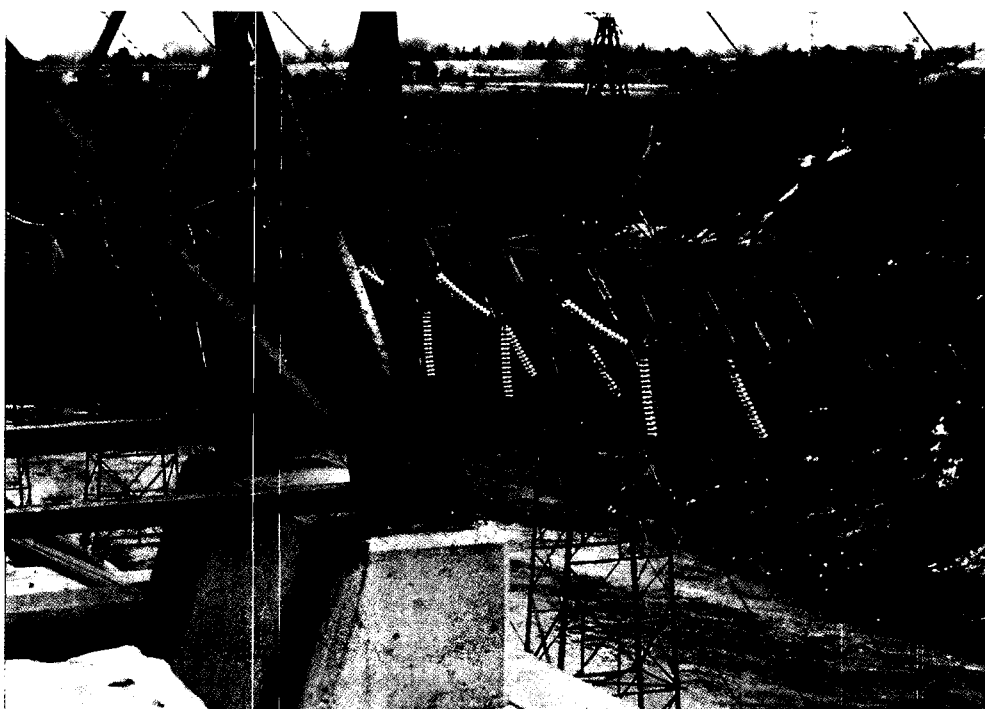
Opportunities for expanded development and trade of natural gas throughout North America ought to be more fully exploited as well. Canada now furnishes around 14 percent of U.S. requirements. New fields are being developed off Canada's east coast between Newfoundland and Nova Scotia. In addition to providing heating fuel for Nova Scotia and New Brunswick, the offshore source could at last bring an end to New England's anomalous dependence on heating oil.

More could be done. Vast quantities of gas, possibly several hundred trillion cubic feet, remain untapped in an area stretching across the Western Canada Sedimentary Basin to Alaska. Known deposits in Alaska and the Yukon alone exceed 70 trillion cubic feet—more than three years of total U.S. consumption at present levels. Official estimates of Mexican proven reserves of natural gas are reportedly half that, but recent estimates by the Gas Technology Institute suggest that as much as 65 trillion cubic feet of gas could turn up in the Burgos Basin of northeastern Mexico.

The importance of bringing more natural gas to the North American market cannot be overstated. Gas can readily displace oil in various ways—as a heating fuel, as a fuel for electric generators (substituting for the oil-fired ones that comprise about half of Mexico's generating capacity, for example), and to an extent, even as a transportation fuel. More important, this relatively clean-burning fuel is the leading alternative to coal. To meet America's anticipated demand for electricity in the near future, as much as 200,000 additional megawatts of electric power may have to be produced nationwide. Across the continent, power plants will spew fewer air pollutants, particularly greenhouse gas emissions, if they are powered by natural gas instead of coal.

NAFTA's Unfinished Business

The energy markets of the United States, Canada, and Mexico would have realized more of their potential by now if the



North American Free Trade Area (NAFTA) had integrated them more completely. But in the energy sector, NAFTA stopped short of achieving a truly open framework for trilateral trade and investment.

The main roadblock remains on the Mexican side, where constitutional provisions, nationalistic sentiment, and raw politics combine to maintain state-owned monopolies that retard growth of that country's oil, gas, and electricity industries. According to the World Bank's estimates, Mexico ought to be financing approximately \$10 billion each year in energy development and infrastructure just to meet its own projected demand, never mind those of its trading partners. Yet, *Petróleos Mexicanos* (Pemex) is required by law to transfer as much as a third of its annual revenues to the Mexican treasury. During 2000, close to \$30 billion in Pemex earnings was turned over, funding 37 percent of the government's general budget but leaving the company unable to plow adequate revenues back

into new exploration and production. Not only do Pemex and the public power company, Comisión Federal de Electricidad (CFE), perennially underinvest; the system of national enterprises (and, in the case of CFE, underpriced electrical rates) also discourages private investors from underwriting Mexico's essential energy projects.

Most of the liberalization of energy trade has been between Canada and the United States. By the time NAFTA was ratified in 1993, Canada had jettisoned the statist energy regime it had erected some 15 years earlier. The government-run monopoly, Petro-Canada, was largely privatized. Gone as well were restrictions on foreign ownership and obstructive price regulations, including the mercantilist practice of imposing supra-market export prices. The result was a rapid rise in Canadian exports after 1983, especially to parts of the American West. By 1991 Canadian natural gas was satisfying approximately 25 percent of California's gas consumption.

Canada, unlike Mexico, did not insist on major exclusivity provisions for energy industries under NAFTA. Thus U.S. and Canadian interests have launched important cooperative ventures in recent years. The Alliance Pipeline—extending over 2,300 miles from western Canada to Chicago—is probably the most striking example. The jointly financed line can carry 1.4 billion cubic feet of gas to the Midwest, and connecting links will eventually deliver a substantial share to locations as far away as Pennsylvania and New York.

But U.S.-Canada energy flows still are not entirely unfettered. Ottawa can negotiate international trade treaties, but jurisdiction over the disposition of natural resources rests with the provinces. Local disputes over key decisions, such as the routing of natural gas lines from the Arctic to the continental United States, continue to cause delays.

All three NAFTA countries could save energy and score big environmental gains if their electric utility grids interfaced seamlessly. Fewer additional generating facilities might be necessary in the future if power could be readily wheeled around the continent to wherever it is needed. But inadequate transmission capacity, unsynchronized connections, and insufficient deregulation (open access) in various local systems continue to pose obstacles. The deficiencies, moreover, are not limited to links between the United States and Mexico, where cross-border sales of electricity are still negligible. To a degree, problems also persist in and among U.S. regions and some Canadian provinces.

What Next?

The United States is not likely to be well served by any national energy strategy that favors, in effect, a buy-American bias when international trade can meet a sizable share of our energy requirements more affordably. Recent events, if anything, underscore this conclusion.

To succeed without massive subsidies, government policies to encourage homemade energy would have to be supported by a sustained period of steep market prices and also by a long suspension of politics as usual. Neither is likely. The ink was barely dry on the Bush administration's National Energy Pol-

icy when market prices shifted unexpectedly. Natural gas, which had run to \$10 per 1,000 cubic feet in early 2001, was closer to \$3 by last summer and headed lower. Crude oil plunged from about \$30 a barrel in early September 2001 to around \$17 a barrel by mid-November. Everywhere, including California (where spot prices of electricity had briefly soared), the energy "crisis"—and thus the urgency of having a "plan"—had faded.

In any case, even the best-laid energy plans are perforce politicized. The Bush initiative is no exception. In the name of furthering "energy independence," a multitude of interest groups make a pitch for their pet projects. Never mind how costly, amid the legislative logrolling any homespun energy scheme—from ethanol farms to synthetic fuels—can make headway. By the time the House of Representatives had finished with the president's proposals, for example, it had authorized more than \$5 billion in subventions to promote an oxymoron: "clean coal." (Power plants using coal treated by so-called fluidized bed technology still emit about 10 times more smog-causing nitrogen oxide than do comparably sized plants fueled by natural gas.)

Instead of futile planning to quarantine "foreign energy providers," U.S. policy should seek deeper integration with some of them, especially the ones next door. In accordance with the aspirations of NAFTA—a genuinely open market for commerce and investment—the three member countries need to be shedding more of their anachronistic energy regulations. In particular, Mexico should be urged to privatize Pemex and the CFE. Before his election President Vicente Fox had intimated that the Mexican government ought to reduce its reliance on Pemex as a cash cow. One way for the United States to encourage reform south of the border might be to swap liberalized immigration rules up here for a firm commitment to restructuring (or, at a bare minimum, much lighter taxation) of the state-controlled energy industries down there.

The United States and Canada, too, can take additional steps congruent with the free-market principles of NAFTA. The installation of new power lines linking U.S. and Canadian utilities, for example, will lag as long as regulators on both sides of the border prevent the utilities from profiting fully from these investments. And negotiating other vital regulatory reforms with our trading partners is complicated by the perpetuation of what they deem to be U.S. trade barriers. Some Canadian provinces complain that "mandated renewable portfolios" in many U.S. states (which allocate substantial market shares of electricity sales to U.S. producers of renewable energy) interfere with exports of electric power from Canada. In 1999, a coalition of independent U.S. oil producers asked the Commerce Department to impose anti-dumping duties on Mexican crude oil.

If politicians in Washington are serious about improving America's energy security, they would do well to clear away such hindrances, and in Mr. Bush's words, "make it easier for buyers and sellers of energy to do business across our borders." ■

Russia

By Fiona Hill

Last fall and winter, as tensions increased in the Middle East and as speculation grew that the Bush administration might extend the war on terrorism into Iraq, the world's news media began trumpeting Russia as a new power in global energy markets. In the *Washington Post* in December, David Ignatius claimed that Moscow is "on its way to becoming the next Houston—the global capital of energy." By January, Russia's President Putin had been hailed by a Canadian paper as "the world's new oil Czar," and the Russian media were replete with commentary on Russia's role as the power broker in world energy markets.

The heightened media attention has raised the possibility that Russia could take on OPEC and help shift global oil supply away from the Middle East and Persian Gulf. Could Russia be poised to become an energy superpower in the 21st century? The short answer is yes, but not in the near future—and not in oil.

Russia may well break into some global energy markets as an alternative supplier to unstable states in the Persian Gulf. But Russia's energy future is in natural gas. As the next decade unfolds, continued crises in the Middle East and growing concern about pollution and global climate change will inevitably focus attention on Russia's vast reserves of cheaper, cleaner natural gas. Russia's success in international gas markets,

however, is not a given. It will depend on major increases in production, serious investments—both foreign and domestic—in infrastructure, and the development of fully functioning gas markets in Asia.

Petrodollars and the Russian Economy

Gas and oil have been the mainstay of the Soviet and now Russian economy for decades. Energy accounts for about half of Russian export earnings. According to Brookings economist Clifford Gaddy, "Every dollar's increase in the price of a barrel of petroleum translates into roughly \$1.5–\$2.0 billion of additional yearly export revenues." During 1999–2000, energy exports accounted

The 21st

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for some 90 percent of Russia's growth in GDP. Thanks to high oil prices, at the end of 2001 the economy had enjoyed its best three-year performance since 1966-69.

Russia's oil industry slumped badly during the 1990s. As the economy contracted sharply from 1990 to 1995, domestic demand for oil fell more than 40 percent, causing a glut on the domestic market. Capacity limits in the country's pipeline system kept lucrative oil exports down. Between 1988 and 1998, Russian oil production fell almost in half—from 11 million to around 6 million barrels a day (mbd). Drilling fell off sharply, as did investment. International investors exploring the Russian oil industry were scared away by the uncertain business climate. Russian oil seemed like a money-loser.

Russia's August 1998 financial crisis, the devaluation of the ruble, and the

subsequent—although entirely unrelated—rise in oil prices revived the industry. The devaluation drastically lowered input costs for Russian energy producers, while sharply higher oil prices boosted revenues even without new investments or production increases.

In 2001, oil companies boosted production and expanded their international reach. Russian companies are drilling for oil in Algeria, Sudan, and Libya. In 2000, LUKoil acquired a chain of gas stations along a stretch of the American East Coast and planned to strengthen its position in the United States by refining crude oil. In Eastern Europe, LUKoil acquired refineries in Ukraine, Romania, and Bulgaria; and YUKOS purchased a major stake in Transpetrol, a Slovak crude pipeline operator.

New regulatory instruments and

fixed tax rates implemented by the Putin government in 2001 greatly improved the investment climate for international operators. In October 2001, Exxon Mobil announced a five-year \$4 billion commitment—Russia's largest single foreign investment to date—to its projects in Sakhalin, Russia's energy-rich island in the North Pacific.

By the end of 2001, Russia was becoming a real international energy player. New stretches of export pipelines had been completed, and a new Russian oil terminal was operating on the Gulf of Finland. Russia concluded an ambitious agreement with the European Union on long-term energy cooperation that would increase oil exports to its neighbor. The European Union already buys more than half of Russia's total oil exports, accounting for some 16 percent of its oil consumption.

Century's Energy Superpower?

Limits on Russian Oil

But for all its recent success, Russia will never displace OPEC in world oil markets. Over the long term, it cannot match OPEC's oil reserves. In oil production, Russia ranks third behind Saudi Arabia and the United States, at just over 7 mbd. In exports, it ranks second, at about 4 mbd, behind Saudi Arabia with close to 7 mbd. But it ranks seventh in proven oil reserves, with only 5 percent—as against the OPEC countries' collective 77 percent. Because of OPEC's huge reserve base the International Energy Agency predicts that increases in world production during 2010–20 will primarily be from Middle East OPEC countries.

One sign of Russia's reserve limits is that its recent oil industry boom was caused by increases in oil *prices*, not *production*. In fact, Russia has yet to restore production to the 11 mbd peak it reached before the collapse of the USSR. And high production costs, together with its limited reserves, will keep Russia from increasing its production capacity far beyond that point. It costs Saudi Arabia a little more than \$5 to produce a barrel of oil; it costs Russia, on average, twice that.

If global recession and depressed world demand send oil prices down again, Russian oil companies could easily slide back into the troubles of the 1990s. For Russia, oil is too volatile a commodity on which to bet its entire future.

Turning Up the Gas

Will Russia fare any better with natural gas? Many in Russia's energy complex think so, and many Russian oil companies are expanding their activities in the gas sector. Russia's gas reserves far exceed those of any other country. Indeed, Russia is to natural gas what Saudi Arabia is to oil. With 32 percent of proven world reserves, Russia far outranks Iran (15 percent), Qatar (7 percent), Saudi Arabia and the UAE (4 percent), and the United States and Algeria (3 percent). Single-handedly, Gazprom, Russia's giant gas company, holds a quarter of all world gas reserves, controls 90 percent of Russian output, and is Russia's largest earner of hard currency. Its tax payments account

for around 25 percent of total federal government tax revenues.

Although oil remains the dominant global fuel source, natural gas is increasing in importance. It now accounts for about 23 percent of world energy consumption and will soon displace coal (at just over 24 percent) in world markets. Increased use of liquefied natural gas and improvements in pipeline technology have transformed gas from a local commodity into an international business.

In the European Union, environmental concerns and significant local reserves have made natural gas the fastest growing energy source. Gas accounts for 22 percent of EU energy consumption (oil still accounts for 44 percent), and Russia has long been Europe's dominant supplier. The EU buys 62 percent of Russia's total gas exports, which in turn account for 20 percent of the EU's overall gas consumption. Since 1997, Russia has also been Turkey's major supplier, accounting for around 70 percent of its gas imports. The Russian government wants to increase exports to Turkey and to double exports to Europe over the next 20 years.

During the 1990s, European gas companies, including Germany's Wintershall and Ruhrgas and Italy's ENI, made considerable investments in Russia's industry. Together, ENI and Gazprom are now building an underwater pipeline, the Blue Stream project, across the Black Sea to transport Russian gas to Turkey. Gazprom also intends to construct a huge trans-European pipeline from its Yamal peninsula in northwest Siberia to Germany; construct a bypass pipeline around Ukraine to avoid siphoning and illegal gas sales from the existing line; and enlist Finland in building another pipeline across the Baltic Sea from northern Russia to Germany. At the end of 2001, with record high export revenues of \$14.5 billion and net profits of \$3.3 billion, the future for Gazprom and Russian gas looked promising.

Northeast Asia also emerged as an important prospective market. The region already accounts for about 20 percent of world energy consumption and, over the next 20 years, may account for a third of the world's total energy demand. China, Japan, and South Korea

would like to meet that demand through increased gas consumption to mitigate the costs of pollution and dependency on Middle East oil. China is especially eager to shift from coal to gas to lessen coal's high environmental toll. Russia's Gazprom seems poised to tap into Asian demand. Three main gas-bearing regions—Yakutiya in Eastern Siberia, Kovytko near Lake Baikal, and Sakhalin Island—are reasonably well situated to serve Northeast Asia. Gazprom recently concluded deals with three of China's largest companies to create a series of joint ventures.

The Caspian Basin and the Geopolitics of Russian Energy

The importance of energy to the Russian economy and Russia's role as a major oil and gas exporter have inevitably influenced Russia's foreign policy. In the 1990s, this was nowhere more evident than in the Caspian Basin, where rich oil and gas deposits and the growing interest and investment of U.S. and international energy companies led to sharp differences between Russia and the United States.

Russia's oil reserves in the Caspian are smaller than those of three other former Soviet regional entities, Azerbaijan, Kazakhstan, and Turkmenistan. During the 1990s, Russia and the three smaller countries squabbled over dividing the spoils of the Caspian Sea and over the direction of new export pipeline routes. For most of the decade, Russia tried to preserve the old Soviet-era legal regime, which would have precluded the division of Caspian resources. It also fiercely resisted U.S.-backed plans to break its monopoly over existing pipelines and to transport Caspian oil across the Caucasus to Turkey.

With the discovery of larger oil reserves than anticipated in the Russian sector of the Caspian and the sudden increase in world oil prices, the Russian government became more amenable to the delimitation of the Caspian Sea. As Russian oil companies prospered, became international players, and searched for new export opportunities, they began to advocate engagement with the United States rather than confronta-

tion in developing the Caspian Basin. In October 2001, a new pipeline to transport oil from a Chevron-led consortium in Kazakhstan to Russia's port of Novorossiisk finally began full operation. At the end of 2001, after years of dissent, LUKoil and YUKOS indicated an interest in the U.S. government's pet project, the Baku-Tbilisi-Ceyhan pipeline from Azerbaijan's fields.

But Russia and the United States remain divided on other global oil issues—especially the interests of Russian energy companies in Iraq. LUKoil has a multibillion-dollar contract in Iraq to rehabilitate major oil fields once sanctions are lifted. In August 2001, Iraq reassigned rights to oil fields previously held by the French to Russia and Russian oil companies. Disagreement on Iraq, U.S. military deployments in Central Asia to support the Afghan campaign, deliberations on the postwar reconstruction of Afghanistan, and the media revival of a 1997 plan by an international consortium headed by Unocal to build a gas pipeline from Turkmenistan across Afghanistan and Pakistan to India have all heightened the sense of regional competition.

Oil was the story of the 1990s in the Caspian, but gas will be the subject in the coming decade if the focus shifts to Central Asia. The Caspian is emerging as a major new global source of gas, with the bulk of proven reserves in Turkmenistan, Kazakhstan, and Uzbekistan. Iran, second only to Russia in gas reserves, is also technically a Caspian state and has exports and greater ambitions in regional markets. Together, Russia and Iran are likely to dominate and direct Central Asian gas flows.

Russia has far more control over Central Asian gas production and exports than it does over Caspian oil. All existing pipeline routes run through Russia, and international energy companies have failed to make the same inroads into Central Asian gas production as they have in Caspian oil.

Russia and Iran will probably also predominate in South Asia. Iran has been willing to serve as a transit country for Turkmenistan's gas and has also engaged in intensive negotiations with both Pak-

istan and India to export its own gas. Iran's proposed pipelines would bypass Afghanistan and also Pakistan if necessary to access the Indian market (with a pipeline under the Persian Gulf). Gazprom is heavily involved in Iranian gas development and has made its own southern pipeline plans. Indeed, in its public announcement of priorities for 2002, Gazprom sketched out three, not two, major markets for the company: Europe, Northeast Asia, and South Asia.

An Emerging but Not Yet "Super" Energy Power

Although geopolitics seem to be working in Russia's favor in world gas markets, the economic picture is less rosy. Gazprom's hopes to penetrate three markets simultaneously are not likely to be realized soon, and it will need significant foreign investment to maintain even its existing exports.

Despite its huge reserves, Gazprom's production has fallen over the past few years as Western Siberian gas fields, which account for 75 percent of current output, have depleted. In 2001, although export revenue and net profit increased, Gazprom's exports fell 4 percent short of its 2001 targets and declined by 3 percent over 2000 volumes. As with oil, high prices—not production—have increased Gazprom revenues. Gazprom also has an estimated \$11–\$13 billion in debt, and over the past decade it has failed to upgrade its existing infrastructure. Only one significant new gas field has been brought on line.

Industry analysts question Gazprom's ability to increase its exports to Europe, as well as to construct new pipelines and meet the anticipated long-term contracts with Northeast Asian countries. Gazprom, they say, will need to maintain control over Central Asian gas reserves to meet European demand—and will need huge foreign investments to realize projects in Asia. To date, Gazprom's strategy has been to export Russian gas to hard-currency markets in Western Europe and leave Turkmenistan to supply former

Soviet states like Ukraine, which have fallen behind in their energy payments to Russia. This strategy will be hard to sustain as regional states try to develop other markets and export routes. More squabbles between Central Asian states and Russia lie ahead.

In Northeast Asia, Gazprom also faces competition from other suppliers, including Australia, Bangladesh, Indonesia, and Malaysia. Even if it can provide the gas, demand is uncertain in the near term. Japan, China, and South Korea still need considerable deregulation and domestic infrastructure improvement to allow energy markets to develop. Japan lacks a domestic natural gas

Its geopolitical location straddling Europe and Asia, with gas fields stretching from west to east Siberia and the island of Sakhalin, gives Russia unique reach.

pipeline network and is in the midst of a financial crisis. South Korea has substantial gas infrastructure in place, but its market is too small for now to justify building overland pipelines from Russia through China and North Korea. China lacks the infrastructure for major domestic gas usage and still needs transportation and urban distribution networks.

While Russia is an important player in world oil markets—especially in Europe—it cannot compete with or displace the Middle East and other OPEC countries over the long term. Changes in global energy consumption and increasing efforts to find alternatives to both oil and coal make gas the resource of the future. Russia's gas reserves are immense and, as yet, not fully developed. Its geopolitical location straddling Europe and Asia, with gas fields stretching from west to east Siberia and the island of Sakhalin, gives Russia unique reach. With significant foreign investment, improvements in production, and the construction of pipelines and other infrastructure, Russia will be able to respond to growing demand for natural gas. Having already made considerable inroads in European gas supplies, it will likely begin to tap into Asian markets in the coming decade. In 2002, Russia is an emerging energy power. It may yet be an energy superpower in the next 20 years. ■

THE

Persian

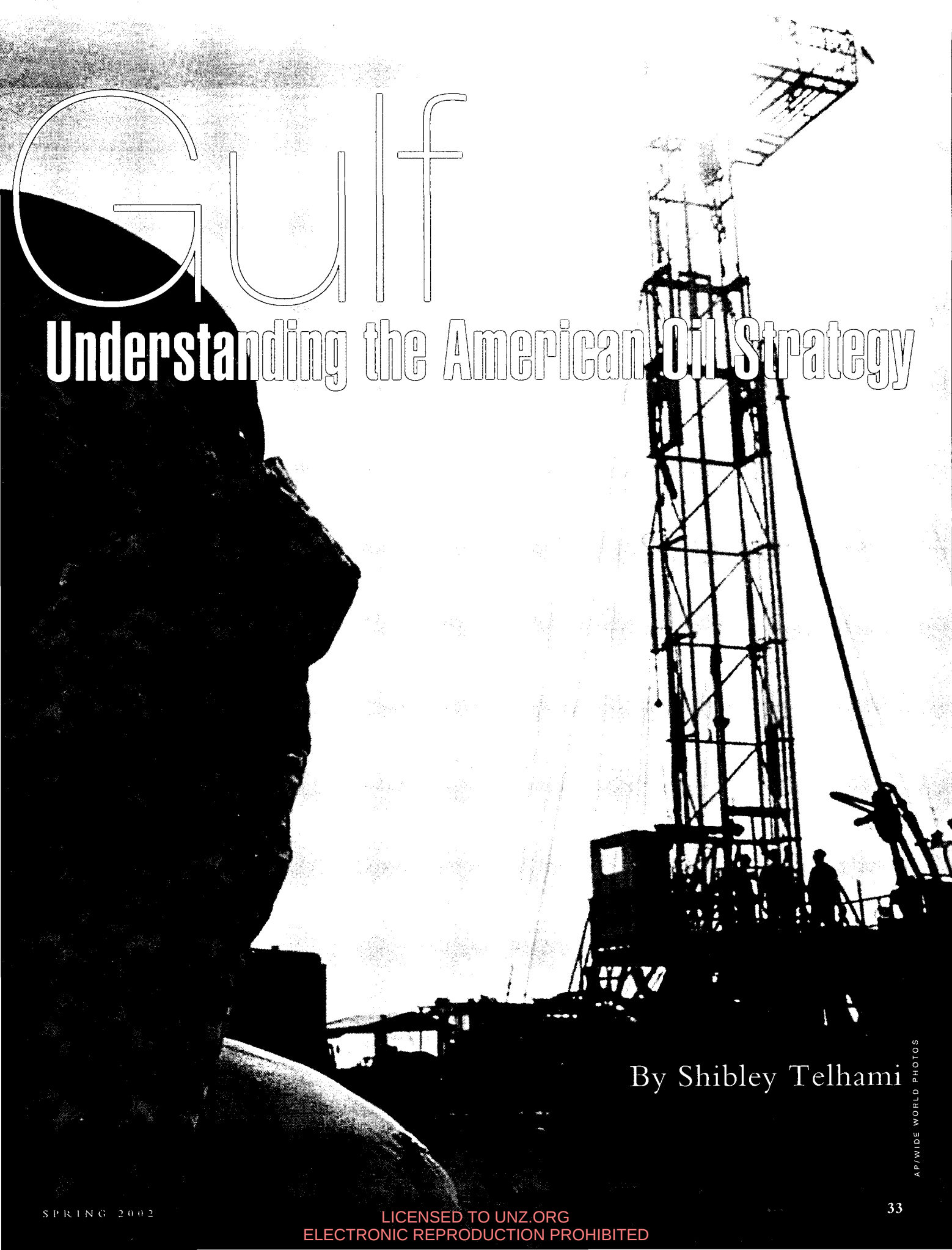
A recent visit to the city of Baku in Azerbaijan on the Caspian Sea called to mind that a century ago, the Caspian region held half the world oil supplies. Half a century ago, the battle of Stalingrad, one of the bloodiest of World War II, was fought in large part over who controlled those vast oil supplies. Today, the region has little to show for it. Still relatively poor and underdeveloped, and environmentally one of the most devastated in the world, it now sees its salvation once again in the promise of newly discovered oil reserves. And once again, Western oil companies and political strategists are showing greater interest in the region as it embarks on a project to build a new pipeline through Georgia and Turkey into the Mediterranean, pumping a million barrels a day in the hope of further reducing the impact of OPEC on the oil markets and meeting projected increases in oil demand.

But there is no escaping that the region that has grabbed the greatest global attention during the past half century in matters of oil, the Middle East, remains critical for future energy supplies. In a way, all the scrambling to develop resources around the world today is intended to delay the day of reckoning. Although the Middle East produces a quarter of world oil supplies, it holds between two-thirds and three-quarters of all known oil reserves. For that reason the United States and the West have continued to define the region as being vitally important.

Addressing Vital Interests

That the region is vitally important, however, does not automatically lead to the conclusion that a large military presence is required there—or to serious questions about the continued availability of this oil on the world market. This seeming revelation has recently provoked a debate in Washington, one focused especially on Saudi Arabia, which alone holds a quarter of the world's known oil reserves. Two central questions have been whether the United States needs to have a military presence in the region at all and whether our primary aim has been to defend Saudi Arabia and other Gulf states with whom we now discover we have serious policy disagreements. Moreover,

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Gulf

Understanding the American Oil Strategy

By Shibley Telhami

AP/WIDE WORLD PHOTOS

many commentators, frustrated with the tension in relations between the United States and Saudi Arabia, have stepped up calls for weaning the United States of foreign oil broadly and of Middle Eastern oil in particular. But the debate entirely misses the logic of the American involvement.

First of all, buying oil from regions other than the Middle East will not resolve the problem. As the adage reminds us, “we are all sipping from the same cup.” The oil market is seamless and is largely driven by supply and demand. Middle Eastern supplies affect the price of Middle Eastern oil, yes, but also the price of global oil. And while the United States can and should conserve energy and develop alternate energy sources, the gap between what the United States now produces and what it consumes (nearly 10 million barrels a day) is simply too wide to be bridged. Moreover, the clustering of the reserves in the Middle East also means that at some point in the not too distant future, a greater share of the oil supply will inescapably be coming from that region.

Nonetheless, it is not entirely clear why oil economics should be mixed with oil politics or what necessitates a military strategy at all. Indeed, many countries that depend heavily on Middle Eastern oil—countries such as Japan and many in Europe—have assumed that they can base their policy entirely on the demands of the market without seeing a need for political and military intervention. This attitude may in part be driven by their taking the United States for granted and assuming that Uncle Sam will do the job to the benefit of all consumers. But there is more to it than that. Outside the United States the view is growing that assuring the flow of oil does not require a significant military strategy. This view is bolstered by historical trends. With the exception of the 1973 Arab oil embargo, which was politically motivated and which led to extraordinary increases in oil prices, long-term evidence suggests that the market, more than any other issue, determines trends in oil prices. Historically, political alliances have not greatly altered patterns of trade between the oil countries and the rest of the world. Oil producers sell oil to the countries that need it and are willing to pay the price and import the best products they can from the best sources they can find. The same was true even during the Cold War years, when political relationships were obviously not central to the oil producers’ trading behavior. A case in point was Libya, which, up until 1969, had been a strategic ally of the West and had hosted British and American military bases. The overthrow of the monarchy there in 1969 and the rise of President Qaddafi shifted Libyan politics in favor of the Soviet Union. Yet its trade patterns before and after the coup were largely the same. For example, the share of trade with Soviet Bloc nations stood at 1.9 percent in 1960 and 1965, 1.8 percent in 1970, 1.3 percent in 1975, and 1.0 percent in 1980. Moreover, moderate states in the Middle East did not differ radically from pro-Soviet states in their trading: the oil-exporting nation with the greatest share of trade with the Soviet Bloc was the Shah’s Iran, not Libya, Algeria, or Iraq. The bottom line was that these states did what was in their economic interest, regardless of their political orientation.

After the 1991 Gulf War, with momentum on the rise for

deploying American forces and establishing what amounted to a new fleet in the Gulf region, some observers believed that the increased American presence would give the United States a decided advantage over Europe and Japan in trade with the Gulf states. In some instances, no doubt, Washington was able to use its political leverage to help American businesses win contracts in the region, especially in the military and aerospace arenas. But at the aggregate level, the trade figures between the region and the rest of the world show that the United States had no visible advantage. In 1989, the year before Iraq invaded Kuwait, European exports to the Middle East stood at \$40.2 billion, as against \$13.7 billion for the United States. In 1992, the year after the Gulf War, Europe’s export total was \$57.2 billion, as against \$19.9 billion for the United States. And the trend continued. In 2000, Europe shipped \$63.7 billion of exports to the Middle East; the United States, \$23.0 billion.

Maintaining the U.S. military presence in the Persian Gulf costs upward of \$60 billion a year. Because these forces can also be used elsewhere, that sum is not entirely spent on defending the region. Still, one wonders why the United States devotes so much of its resources, energies, and war planning to the Persian Gulf. Would it not be more sensible to leave the oil issue to market forces and to leave politics out of it?

As conventionally understood, the American strategy is based on a resolve to assure the flow of oil to the West at reasonable prices—a resolve that extends to mitigating short-term interruptions in oil supply and subsequent spikes in pricing by relying on states, notably Saudi Arabia, that have excess capacity. (This alone requires Saudi-U.S. cooperation to assure that the Saudi capacity is used as a moderating force on the oil market.) But for more than half a century a central drive behind the American military strategy in the oil-rich region—one that has been not fully understood by most analysts—has been to deny the control of such vast resources to powerful enemies who would thereby become even more powerful and thus more threatening.

The Genesis of the Oil-Denial Policy

As the Cold War was moving to center stage in American foreign policy in 1948, a new worry emerged in the White House: that the Soviet Union could come to control oil supplies in the Middle East. It is no coincidence that much of the early preoccupation with the potential Soviet threat after the end of World War II centered on the remaining Soviet presence in Iran. But unknown to the public until the recent declassification of National Security Council documents (first uncovered by a reporter for the *Kansas City Star*, Steve Everly) was the extent of Truman administration concern about the possible Soviet takeover of the oil fields. Equally surprising was that the Truman administration built its strategy not so much on defending the oil fields in the face of a possible Soviet invasion, as on denying the Soviet Union use of the oil fields if it should invade.

The administration quickly developed a detailed plan that was signed by President Truman in 1949 as NSC 26/2 and

later supplemented by a series of additional NSC directives. The plan, developed in coordination with the British government and American and British oil companies without the knowledge of governments in the region, called for moving explosives to the Middle East, where they would be stored for use. In case of a Soviet invasion, and as a last resort, the oil installations and refineries would be blown up and oil fields plugged to make it impossible for the Soviet Union to use the oil resources.

So great was the fear that the Soviets might exploit the region's oil that the administration considered deploying "radiological" weapons. Ultimately that option was rejected by the Central Intelligence Agency, as revealed in another recently declassified document, NSC 26/3, dated June 29, 1950. The explanation was this: "Denial of the wells by radiological means can be accomplished to prevent an enemy from utilizing the oil fields, but it could not prevent him from forcing 'expendable' Arabs to enter contaminated areas to open well heads and deplete the reservoirs. Therefore, aside from other effects on the Arab population, it is not considered that radiological means are practicable as a conservation measure." In other words, the logic of the rejection was that besides denying oil to the enemy, the policy also sought future "conservation" of oil, which "means a preservation of the resources for our own use after our reoccupation." Ultimately, more conventional plugging methods were recommended.

The plan was implemented and explosives were moved to the region. Although the State Department apparently expressed reservations that the plan might ultimately signal that the United States was not prepared to defend the local governments, the fear of Soviet control overwhelmed such concerns. Worries intensified still further in 1957, leading the Eisenhower administration to reinforce the plan as fears of regional instability grew following the Suez crisis. Evidence suggests that the plan remained in place at least through the early 1960s.

Denying Oil to Potential Enemies Today

Today, the prevailing perception in Washington is that Iraq and Iran are aggressive, dangerous states. Deterring their ability to encroach on Saudi oil fields—hence denying these states additional oil revenues—is one aim of the continuing American presence in the region. The underlying concern is not just about possible disruptions in oil supplies, and ensuing price shocks, that the actions of hostile regimes could occasion. The larger issue, from the standpoint of the United States, is that if Iraq or Iran were to enrich themselves by taking control of additional oil reserves, these regimes would soon become more menacing to the United States than they already are, *even if they were eager to sell to the rest of the world all the oil they seized.*

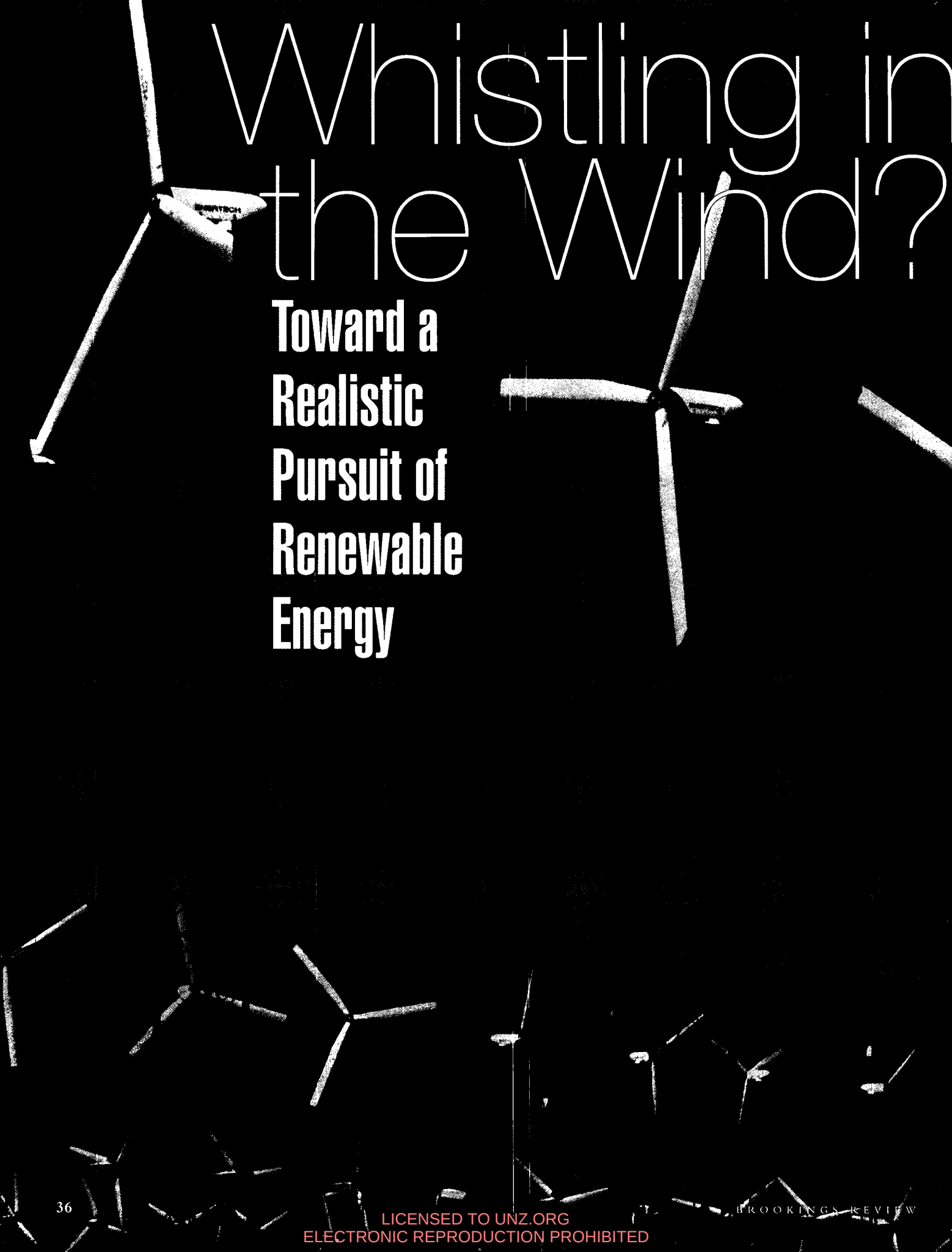
The extent to which Iraq and Iran are a threat will remain a matter of debate. Do they pose a threat to the United States? Or is the U.S. concern more for its friends in the region, especially Israel, for whom the two states are potential threats? It is hard to imagine the circumstances under which the current governments in Iraq and Iran (but especially in Iraq) will be seen as anything less than aggressive and threatening, especially

since President Bush has declared them, together with North Korea, as the "evil axis" that will feature centrally in the war on terrorism. This outlook makes it likely that any American administration in the foreseeable future will continue to try to prevent these two states from coming to control the bulk of the world's known oil reserves—independent of U.S. concern for friendly Arab governments in the Gulf.

But whatever the reasoning behind the American military strategy, it remains in the interest of the Gulf Cooperation Council states to have American military backing. That gives the United States some leverage, but only up to a point since GCC states know that the U.S. strategy also serves American interests. The result is clear mutual incentives to cooperate. Certainly, when threats to oil are clear, as in the Iraqi invasion of Kuwait in 1990, Saudi Arabia and other GCC states will undoubtedly rally behind the United States to defend the oil fields. And even without imminent threat, GCC states, especially Kuwait, have an interest in the U.S. presence in the region. U.S. forces are spread throughout much of the Gulf, from prepositioned equipment in Qatar, to forces and equipment in Kuwait, to the naval facilities in Bahrain. The Saudis, who also host American troops, have incentives to maintain an American presence in the region even as they seek to lower the numbers and the profile of American forces on their own soil for fear of public backlash.

The extent to which the Saudi public resents the American presence as such is not entirely known (although obviously segments of that public do). What is clear is that much of the resentment of the United States is a function of the Arab-Israeli conflict, which has been a visible sore point in the U.S.-Saudi relationship in the past year. The Saudi government is reflecting a pervasive public mood on this issue. In a survey I conducted in Saudi Arabia last summer, 63 percent of Saudis ranked the Palestinian issue as "the single most important issue" to them personally, and another 20 percent ranked it among the top three. In a new survey among Saudi elites in late January, 66 percent said that their frustrations with the United States would be completely removed or significantly reduced if Washington could succeed in brokering Arab-Israeli peace. Importantly, 86 percent said that their frustrations with the United States are based on "its policies" and only 6 percent said they are based on "its values."

But in the months since September 11, the Saudis have discovered that their public perception of the illegitimacy of the American presence on their soil is a threat to them as well as to that presence—just as the United States has discovered the depth of public resentment in the region. This will necessitate mutual cooperation. The Saudis will have to transmit to their public the sort of friendship with America that has existed at the governmental level, and the United States will need to work with them to reduce the level and the profile of American forces without jeopardizing its military strategy. The Saudis will continue to need American backing, and the United States will continue to need their cooperation. The Gulf region and its immense oil reserves will only become more important for the global economy in the future. ■



Whistling in the Wind?

Toward a Realistic Pursuit of Renewable Energy

To its adherents, renewable energy is all but ideal. Its virtues are twofold. First, unlike conventional energy sources, renewables exist in such abundance as to eliminate scarcity as a factor in long-term energy concerns and planning. Second, renewables have an environmental integrity that fossil energy resources, with their emissions of greenhouse gases and other pollutants, cannot claim. As often happens, however, when the pursuit of laudable goals achieves virtually iconic status, the facts are more complicated.

Even the term "renewables" turns out to be more ambiguous than it seems. Extracting energy from geothermal basins, for example, is routinely viewed as a renewable energy strategy. But such basins are, strictly speaking, exhaustible: a given site may lose useful heat after years of extraction. And uranium ores are viewed as depletable in a geologic sense and typi-

cally excluded from the renewables category. But uranium ores could accommodate nuclear power generation as far into the future as one might be inclined to consider. The constraints are not geologic, but political, economic, and technological.

When it comes to renewable energy, realism is in order. Can renewables contribute to the nation's longer-run energy requirements? Yes, they can—although in terms of their cost and market potential, they still have a long way to go. What is the status of renewables today, and how might they reasonably be expected to evolve in the years to come?

The Case of Electric Power

Probably the most promising application of renewable sources lies in generating electric power. The four systems most commonly put into the renewables rubric are variants of solar energy (thermal or photovoltaic applications), biomass-derived fuels, geothermal resources, and windpower. Sometimes the list expands to include energy derived from municipal wastes. (In several European countries, the harnessing of tidal energy is being explored as a more visionary objective.)

Conspicuously missing from the preferred list of renewables capable of generating electricity are conventional hydroelectric dams, though in principle, they too can generate power in perpetuity. The exclusion of hydropower from most discussions of renewable energy may be understandable, because even existing dams, much less newly planned ones, are widely seen as inimical to a whole range of social imperatives—integrity of ecological systems, preservation of cherished historic or cultural values, commercial and recreational fishing, and other leisure-time activities.

Table 1 puts renewables into a national electricity perspective. Nonhydroelectric renewable resources account for just a bit more than 2 percent of total generation today. The Department of Energy projects that their share will reach somewhere between about 3 percent and a little more than 5 percent by 2020. Some observers, citing developments in the past several years, view those forecasts as much too timid.

Judging Renewables'

Economic Performance

The critics' argument has considerable merit. A 1999 study conducted at Resources for the Future found that although both advocates and more agnostic analysts had expected the costs of renewables-based electricity generation to fall during the 1980s and 1990s, the declines were greater than expected—in some cases, markedly

By Joel Darmstadter

Public Support for Renewables R&D: Some Questions

Government's role in supporting renewables research and development seems less arguable than some of its mandatory purchasing and tax-based policies. During 1978–98, renewables R&D spending amounted to around \$13 billion. Of that sum, roughly \$2.5 billion went for solar photovoltaics and \$1.5 billion for windpower (figures in 1999 dollars). As such programs continue to unfold in the years to come, some questions are worth pondering (though offering answers may not be nearly as easy).

- Might it be worth trying to isolate the effect of federal support from other factors contributing to the economics of renewables? Society is entitled to some sense of the return from such public-sector R&D spending.
- To what extent is federal R&D for renewables driven by a failure to account fully for the (presumably greater) externalities of fossil fuel combustion? While some externality calculations—such as damage associated with greenhouse warming—are highly tentative, the 1.7 cents per kilowatt hour windpower tax credit seems to breach the upper limit of most researchers' estimates.
- Conceding that the line of demarcation between basic research support and promotion of commercial development is blurred, is the federal priority sufficiently weighted to the former to avoid "crowding out" private-sector initiatives? (A General Accounting Office critique has found the Energy Department to be lax in respecting that line.)
- Within some inescapable limits on the overall Energy Department budget, is there a compelling case for a shift to different programs whose social payoff would be significantly greater? After all, the Energy Department's purview extends over a wide range of activities—energy efficiency, reactor development and nuclear waste management, automotive technologies, to name just a few. Within its renewables budget, are shifts justified by the criterion of economic effectiveness? For example, in its analysis of budget options over the next 10 years, the Congressional Budget Office notes that the department's R&D support of biomass-to-liquid fuels ranks as high as solar photovoltaics in projected renewables spending. Yet the politically popular biomass program is highly questionable on economic grounds. Currently, overall Energy Department outlays on R&D for renewables run at around \$300 million a year; the total for photovoltaics, wind, and other solar, at \$134 million a year; and for biomass, \$96 million a year. And this direct department spending for "biomass R&D" is not to be confused with the enormous (now approaching \$1 billion a year) tax expenditures represented by the federal gas tax exemption on ethanol production. (No one who has observed the expansion of that ultra-generous support over the years can have any illusions that it is anything but a political gift to grain processors and the U.S. agricultural lobby.)

Table 1. U.S. Electricity Generation, 2000

SOURCE	BILLION KILOWATT HOURS	PERCENTAGE SHARE OF TOTAL
Conventional hydro	276	7.2
Other renewables	81	2.1
Fossil and nuclear	3,488	90.7
Total	3,845	100.0

Source: Department of Energy, Energy Information Administration, *Annual Energy Outlook 2002* (Dec. 2001), Tables A8 and A17.

Notes: Because of streamflow variability, the conventional hydro share fluctuates. In 1999, it accounted for 312 billion kwh or 8.4 percent. "Other renewables" include those described in the text as well as combustion of municipal solid waste and landfill gas.

so. A quarter century ago, the cost of windpower generation, then estimated at around 60 cents per kilowatt hour, was not expected to fall much below 8–10 cents per kilowatt hour by the end of the century. But current bids for new windpower facilities appear to be in the range of 3–5 cents per kilowatt hour, depending on location. (Throughout, references are to constant-dollar costs, expressed in 1999 prices.) The cost of solar applications remains substantially higher.

Given the sharp decrease in costs, why has the market share of renewables remained so low? Because, to an important degree, the costs of conventionally fueled electric generation also fell sharply. Those costs had been expected to head in only one direction—upward—during

the final two decades of the 20th century. The Department of Energy, for example, had projected that the overall cost of generating electricity would rise about 5 percent between the early 1980s and mid-1990s. In fact, it fell 40 percent—a decline triggered largely by an unexpectedly large drop in the cost of fuels used for conventional power generation. And even apart from what may happen to these fuel prices in the future, it stands to reason that technological improvements in power production will apply not just to renewables but to their nonrenewable competitors as well, thus hampering the former's success in gaining market share. The technology of choice for power generation in the foreseeable future is the highly efficient combined cycle gas turbine (CCGT), an advanced ver-

Further References

The National Renewable Energy Laboratory website provides links to useful data and information on technological developments. (Go to <http://www.nrel.gov/>.) The Energy Information Administration publishes an annual statistical compendium, *Renewable Energy: Issues and Trends*. Go to http://www.eia.doe.gov/cneaf/solar.renewables/rea_issues/rea_issues_sum.html.

sion of which may well be able, within the next decade or two, to produce power below today's nationwide average generation cost of around 4 cents per kilowatt hour. The CCGT may constitute a formidable challenge to windpower and other renewables, most of which bear an economic burden not shared by a "base-load" CCGT plant—namely, the fact that their "intermittency" limits their ability to dispatch power on demand.

A recent study by Resources for the Future compares the costs of renewables-based and conventional electric power facilities coming on line over the next 20 years and sees windpower emerging as the most promising renewable. But, not surprisingly, windpower's competitive attractiveness turns out to be highly sensitive to assumptions about continued progress in CCGT technology.

Markets and Government

A perennial issue in evaluating the economic prospects of renewable energy is the relative role of markets and government. To what extent should renewable energy's future depend on the interplay of market forces? To what extent do renewables deserve the helping hand of government? Proponents of renewable energy, pointing to its largely benign environmental features and couching their argument in "level playing field" terms, suggest that renewables are entitled to at least a measure of public support to offset policies favoring fossil and nuclear energy. On the other hand, does it make sense to compound the problems of the current system—which sanctions the underpricing of conventional systems by not requiring them to bear the costs of "externalities" like emissions of carbon dioxide or mercury—and to inflate consumer

demand for electricity still further by using subsidies to relieve the cost disadvantages of renewables? Would it not be more rational to tax or cap emissions to make nonrenewables accountable for their real costs?

One can be too churlishly purist in such debates. An approach that accords renewables some reasonable amount of financial assistance for research tied to development of basic technology—keeping in mind that building scientific and technological knowledge is a legitimate public-sector responsibility—is hard to quarrel with. Renewables have already made fruitful use of such support. The federal government, for example, along with its national laboratories, universities, and industrial stakeholders, sponsors work designed to achieve higher efficiencies, reduced system costs, and longer life in solar photovoltaic modules. The Department of Energy's National Renewable Energy Laboratory has also been active in the design of airfoils in utility-scale wind turbines. These and numerous other efforts have led to a level of public support for renewables that has scarcely been paltry. Still, how to ensure a fair shake for different programs and beneficiaries is not simple (see accompanying boxes).

Government support for renewable energy will almost certainly continue, whether at modest or sharply higher levels. Such support, however, would be misguided if it tried to target energy market outcomes that favor one or another energy source. A two-pronged policy that penalizes conventional fuels for their as yet uncontrolled damage to the environment while concurrently helping renewables sustain their ongoing technological momentum would be a constructive policy for resource use and for society at large. ■

Government Support for Renewables Production

If renewable energy is to come into its own, it must realize its potential for cost reduction and technological improvement within the reality of a competitive electric generation market. Is government support for renewables production a legitimate means of closing the gap between potential and reality?

Many observers would argue that it is. Given a technological state of the art that remains elusive and economic prospects that are still distant, firms may underinvest in renewable systems that nonetheless promise substantial, if not always appropriable, social benefits—for example, a diminished threat of global warming or, conceivably, a more resilient electricity infrastructure.

But this somewhat abstract rationale for subsidization does not provide an easy basis for judging the reasonableness of actual or proposed expenditures. Renewables have enjoyed public support from a variety of measures over the past quarter century. Not all have met expectations.

- The federal Public Utility Regulatory Policies Act of 1978 required utilities to purchase power (prominently, though not exclusively, renewables-based) from nonutility producers at prices that were supposed to represent the "avoided cost" they would otherwise have had to pay to produce power using conventional resources, such as petroleum. The design and operation of the law were badly flawed, however, and it is widely judged to have fallen far short of its objectives in promoting real market penetration by renewables.
- Renewables have also benefited from a variety of financial inducements—investment tax credits, preferential depreciation schedules, and production tax credits. The most significant was a 1.7 cents per kilowatt hour credit for windpower—a generous credit, considering a nationwide generation cost averaging around 4–5 cents. (The credit expired at the end of December 2001 but may be restored.)
- Some state energy policies have included, or may soon feature, initiatives to make renewables a larger fraction of the electricity mix. In a twist of its own, Minnesota requires a major utility to commit around 550 megawatts (including 425 megawatts in windpower) of renewable generating capacity in the next few years. The obligation is a quid pro quo; in exchange, the state will allow the utility to continue to accumulate radioactive waste at its nuclear power plant beyond a mandated deadline. Of course, the technology-forcing thrust of such initiatives cannot realistically ignore the market price for electricity, which may set a limit on renewables' ability to compete.

Terrorism Nuclear

By Gwyneth Cravens

Gwyneth Cravens has written about science and public health for the New York Times, Harper's, and other publications. She is collaborating with Charles Platt on a book about nuclear issues.

Assistance with technical information for this article was provided by Dr. Richard Anderson, a scientist specializing in risk assessment and environmental health and safety at Sandia National Laboratories until his retirement last December.

Based on science, what should Americans worry about? Is radiation always dangerous? How do we protect ourselves? Could terrorists unleash a Chernobyl on our soil? Could nuclear waste dumps or power plants be transformed into atomic weapons? Could terrorists make a “dirty” bomb capable of widespread contamination and deaths from radiation? Could they steal an American nuclear weapon and detonate it?

The Energy Department’s nine national laboratories have begun an extensive review of counterterrorism, including the vulnerability of U.S. nuclear sites and materials. Some findings may remain undisclosed for security reasons; others may be made public—soon, one hopes. Meanwhile, here are some basics.

Radiation

Radioactive materials contain unstable atoms, radionuclides, that emit excess energy as radiation, invisible but detectable by instrument. Some atoms lose their energy rapidly; others remain dangerous for thousands, even millions of years. Certain forms of radiation are more hazardous to humans, depending on the type of particles emitted.

The United Nations Scientific Committee on the Effects of Atomic Radiation (UNSCEAR), composed of scientists and consultants from 21 nations, provides comprehensive evaluations on sources and effects of radiation as the scientific basis for estimating health risk. UNSCEAR’s reports are almost uni-

versally considered objective and reliable. It recently listed annual average exposures per person worldwide.

Natural background radiation: 240 millirem worldwide (300 millirem in the United States). The earth’s core is a natural reactor, and all life evolved within a cloud of radiation stronger than background radiation is today. Cosmic rays, sunlight, rocks, soil, radon, water, and even the human body are radioactive—blood and bones contain radionuclides. Exposure is higher in certain locations and occupations than in others (airline flight personnel receive greater than average lifetime doses of cosmic radiation).

Diagnostic medical radiation: 40 millirem (60 millirem in the United States). This is the largest source of manmade radiation affecting humans. Other common manmade sources include mining residues, microwave ovens, televisions, smoke

detectors, and cigarette smoke—a pack and a half a day equals four daily chest x-rays.

Coal combustion: 2 millirem. Every year in the United States alone, coal-fired plants, which provide about half of the nation’s electricity, expel, along with toxic chemicals and greenhouse gases, 100 times the radioactivity of nuclear plants: hundreds of tons of uranium and thorium, daughter products like radium and radon, and hundreds of pounds of uranium-235. Radioactive fly ash, a coal byproduct used in building and paving materials, contributes an additional dose. Coal pollutants are estimated to cause about 15,000 premature deaths annually in the United States.

Nuclear power: 0.02 millirem (0.05 in the United States). The Environmental Protection Agency, whose standards are the world’s strictest, limits exposure from a given site to 15 millirem a year—far lower than average background radiation.

For radiation to begin to damage DNA enough to produce noticeable health effects, exposure must dramatically increase—to about 20 rem, or 20,000 millirem. Above 100 rem, or 100,000 millirem, diseases manifest. Whether low-dosage radiation below a certain threshold poses no danger and may in fact be essential to organisms is controversial (the Department of Energy began the human genome project to help determine if such a threshold exists). If exposure is not too intense or prolonged, cells can usually repair themselves. Radiation is used widely to treat and to research illnesses.

The horrible—and preventable—reactor explosion at Chernobyl caused fatalities and suffering among the local population but increased the overall background radiation level by a factor of only 0.00083 worldwide. According to UNSCEAR, contamination greater than background radiation was limited to 20 square miles around the plant. The severest casualties occurred among plant workers and firemen, two of whom died from scalding. Another 134 suffered acute radiation sickness. Twenty-eight of those victims died within three months; 13 succumbed later. The rest survived.

Among civilians in surrounding communities, UNSCEAR found 1,800 cases of thyroid cancer, mostly in children, and predicted more would develop. Thyroid cancer could have been avoided, however, had the entire population surrounding Chernobyl been promptly given potassium iodide, which blocks the uptake by the thyroid of radio-iodine, a radionuclide produced by reactors.

Fourteen years after the accident, no other evidence of a major health effect attributable to radiation exposure had been found. The UNSCEAR report states: “There is no scientific evidence of increases in overall cancer incidence or mortality or in non-malignant disorders that could be related to radiation exposure. The risk of leukemia, one of the main concerns owing to its short latency time, does not appear to be elevated, not even among the recovery operation workers. Although those most highly exposed individuals are at an increased risk of radiation-associated effects, the great majority of the population are not likely to experience serious health consequences from radiation from the Chernobyl accident.”

Energy

Understanding the Risks

What UNSCEAR also found was that “the accident had a large negative psychological impact on thousands of people.” Fear, born of ignorance of real risk coupled with anxiety about imagined harm, produced epidemics of psychosomatic illnesses and elective abortions. Better management of the emergency, including adequate dissemination of facts, probably could have prevented much of this psychic trauma. Risk perception tends to be skewed by unexpected, dramatic events—a quirk of human nature exploited by terrorists. More severe risks almost always lurk in everyday life: cardiovascular disease (about 2,286,000 U.S. deaths annually), smoking-related illnesses (over 400,000), and motor vehicle accidents (about 42,500).

That other accident-related cancers may eventually appear around Chernobyl is possible but unlikely, given results of long-term surveys of the approximately 85,000 survivors of the bombs exploded over Hiroshima and Nagasaki in 1945. Despite the far higher dosages of radiation to which these victims were exposed, recent data cited by Fred Mettler, U.S. representative to UNSCEAR and chairman of the Radiology Department at the University of New Mexico, show that 12,000 have died of cancer—700 more than would be expected. (Normally about one in three humans gets cancer.)

A few years ago, after much debate, the U.S. Nuclear Regulatory Commission offered free emergency contingency supplies of potassium iodide to the 31 states with reactors, but most declined. Illinois has 11 reactors; its officials feared that the pills—“a cruel hoax”—would fool people into thinking they were safe from radiation; they and officials in other states argued that evacuation was the best protection. Delay from the Food and Drug Administration regarding approval of the antidote, as well as opposition to it at the county level, created further obstacles. After September 11, communities and politicians expressed indignation that this inexpensive drug had not been stockpiled. Last December, the NRC announced that it would require states with populations within the 10-mile emergency planning zone of a nuclear power plant to consider “including potassium iodide (KI) as a protective measure for the general public in the unlikely event of a severe accident. This measure would supplement sheltering and evacuation, the usual protective measures.” Nine states have now requested tablets.

Reactors

Could any of the 103 nuclear reactors in the United States be turned into a bomb? No. The laws of physics preclude it. In a nuclear weapon, radioactive atoms are packed densely enough within a small chamber to initiate an instantaneous explosive chain reaction. A reactor is far too large to produce the density and heat needed to create a nuclear explosion.

Could terrorists turn any of our reactors into a Chernobyl? Again, extremely unlikely. American reactors have a completely different design. All reactors require a medium around the fuel rods to slow down the neutrons given off by the controlled chain reaction that ultimately produces heat to make steam to turn turbines that generate electricity. In the United States the medium is water, which also acts as a coolant. In the Chernobyl reactor it was graphite. Water is not combustible, but

graphite—pure carbon—is combustible at high temperatures. Abysmal management, reckless errors, violation of basic safety procedures, and poor engineering at Chernobyl caused the core to melt down through several floors. A subsequent explosion involving steam and hydrogen blew off the roof (there was no containment structure) and ignited the graphite. Most of the radioactive core spewed out.

A similar meltdown at the Three Mile Island power plant in 1979—one caused by equipment malfunctions and human failure to grasp what was happening and respond appropriately—involved no large explosion, no breach. The reactor automatically shut down. Loss of coolant water caused half the core to melt, but its debris was held by the containment vessel. Contaminated water flooded the reactor building, but no one was seriously injured. A minute quantity of radioactive gases (insignificant, especially in comparison to the radionuclides routinely discharged from coal-fired plants in the region) escaped through a charcoal-filtered stack and was dissipated by wind over the Atlantic, never reaching the ground. The people and land around the plant were unharmed.

In response, the NRC initiated more safeguards at all plants, including improvements in equipment monitoring, redundancy (with two or more independent systems for every safety-related function), personnel training, and emergency responsiveness. The commission also started a safety rating system that can affect the price of plant owners’ stock. The new science of probabilistic risk assessment, developed to ensure the safety of the world’s first permanent underground nuclear waste-disposal facility, has led to new risk-informed regulation. In over two decades no meltdowns have occurred and minor mishaps at all nuclear plants have decreased sharply. Cuts by Congress in the NRC’s annual research budget over the past 20 years—from \$200 million to \$43 million—may have considerably compromised ongoing reforms and effectiveness, however.

U.S. nuclear power plants, which are subject to both federal and international regulation, are designed to withstand extreme events and are among the sturdiest and most impenetrable structures on the planet—second only to nuclear bunkers. Three nesting containment barriers shield the fuel rods. First, metal cladding around the rods contains fission products during the life of the fuel. Then a large steel vessel with walls about five inches thick surrounds the reactor and its coolant. And enclosing that is a large building made of a shell of steel covered with reinforced concrete four to six feet thick. After the truck-bomb explosion at the World Trade Center in 1993 and the crash of a station wagon driven by a mentally ill intruder into the turbine building (not the reactor building) at Three Mile Island, plants multiplied vehicle and other barriers and stepped up detection systems, access controls, and alarm stations. Plants also enhanced response strategies tested by mock raids by commandos familiar with plant layouts. These staged intrusions have occasionally been successful, leading to further corrections. On September 11, all nuclear facilities were put on highest alert indefinitely. Still more protective barriers are being erected. The NRC, after completing a thorough review of all levels of plant security, has just mandated additional per-

sonnel screening and access controls as well as closer cooperation with local law-enforcement agencies. Local governments have posted state troopers or the National Guard around commercial plants, and military surveillance continues.

What if terrorists gained access to a reactor? An attempt to melt down the core would activate multiple safeguards, including alternate means of providing coolant as well as withdrawal of the fuel rods from the chain reaction process.

And if a jetliner slammed into a reactor? Given what is now publicly known, one could predict that earthquake sensors, required in all reactors, would trigger automatic shutdown to protect the core. Scientists at the national labs are calculating whether containment structures could withstand a jumbo jet, specifically the impact of its engines, which are heavier than the fuselage, and any subsequent fire. Even the worst case—a



reactor vessel breach—would involve no nuclear explosion, only a limited dispersal of radioactive materials. The extent of the plume would depend on many variables, especially the weather. As a precaution, no-fly zones have been imposed over all nuclear power plants. Military reactors used for weapons production have all been closed for a decade and are spaced miles apart on isolated reservations hundreds of miles square. Any release of radioactivity would remain on site.

Commercial Nuclear Waste

Commercial radioactive waste is generated chiefly by nuclear power plants, medical labs and hospitals, uranium mine tailings, coal-fired power plants (fissionable materials are concentrated in fly ash), and oil drilling (drill-stems accumulate radioactive minerals and bring them to the surface).

Nuclear power provides about one-fifth of the energy the United States needs for electricity generation. At plants around the nation, in deep, steel-lined, heat-reducing pools of water, spent-fuel rods are accumulating in temporary storage. In the 1950s the National Academy of Sciences determined that deep geologic disposal is the safest means on land of permanently isolating nuclear waste. Congress designated Yucca Mountain, at the Nevada Test Site—scene of more than 1,000 atomic blasts—as the first permanent U.S. repository for spent fuel. Its burial has been the goal of the Energy Department and the

NRC for decades, but political and bureaucratic obstacles, rather than lack of scientific know-how, have slowed progress. If the present timetable holds, and if political support is forthcoming—still an open question despite President Bush's recent approval of Yucca Mountain—shipments of spent fuel from plants will begin around 2015.

These days citizens have become acutely aware of the waste pools and have questioned their presence in populated areas, yet environmental activists have long sought to keep nuclear waste at power plants, insisting that its removal poses grave dangers. This view, though unsupported by the EPA, the NRC, and numerous risk-assessment studies (nuclear materials are transported daily around the nation without mishap, in contrast to accidents regularly associated with transport of toxic chemicals), has also resonated with politicians. Nevertheless, growing concern about fossil-fuel pollutants and global warming and the realization that nuclear power has spared the atmosphere from billions of tons of carbon dioxide emissions may be encouraging a change of attitudes.

Challenges regarding subterranean disposal have already been solved. Because of breakthrough methodologies evolved during construction (by the Energy Department) and certification (by the EPA), New Mexico's Waste Isolation Pilot Plant is the world's first successful deep geologic repository for the permanent isolation of federal (as opposed to commercial) nuclear waste. It is a model for other nations. For political reasons, WIPP is permitted by Congress and the state of New Mexico to accept only certain military waste. But nearly 1,000 detailed studies, as well as an innovation in probabilistic risk assessment invented by WIPP's scientists, have demonstrated that its remoteness, size, and stable geological and climatological features make it the safest place to store any type of waste. In fact, if enlarged or annexed, the WIPP could hold all U.S. nuclear waste generated for decades to come.

Would a jet plane crashing into a waste pool cause a nuclear explosion? Given information now available, one can state that if the small target a pool presents were actually hit and coolant water were drained, spent fuel bundles would melt, react with the concrete and soil below the pools, and solidify into a mass—in effect causing containment. Some radionuclides would be vaporized and scattered, but in a very limited fashion, since spent-fuel rods lack immediately releasable energy. The waste pools contain practically no burnable materials.

In dry-cask storage, an innovation safer than waste pools, a single bundle of rods is entombed in a thick concrete cylinder, 18 feet tall and 8 feet across, designed to withstand powerful impacts and widely separated from its neighbors. Air is the coolant. If one bundle somehow failed, not enough heat would be available to cause it or other bundles to melt. Sixteen plants have already converted to dry casks, and more will follow.

Could terrorists steal spent nuclear fuel? First they would have to get past multiple impediments: guards, high double fences with concertina wire, floodlights, motion detectors, and cameras. Fuel rods are so radioactive that anyone coming within a few feet of them would become extremely ill and die

within hours if not minutes. The more radioactive something is, the harder it is for someone to steal—and survive. Special equipment and thick lead shields are required for handling, and spent fuel for transport must be placed in casks weighing about 90 tons that have been stringently tested (burned with jet fuel, dropped from great heights onto steel spikes, and otherwise assaulted) and have remained impervious.

Could terrorists make a nuclear weapon from commercial U.S. reactor fuel? Not easily. It is enriched with uranium-235 but not nearly enough to make it weapons-grade. Extracting the enriched uranium-235 would require a large, sophisticated chemical separation plant.

Weapons Facilities

Could terrorists rob a weapons facility of weapons-grade plutonium or uranium? Mock raids of the kind used to test nuclear power plants have been conducted to uncover weaknesses at weapons research sites. The exercises have demonstrated the need for maximum protection and independent oversight of security forces as well as of the network used to transport weapons materials. Since 10 a.m. on September 11, these sites have been placed on highest security. Precautions at some nuclear weapons facilities abroad are almost certainly weaker than here—and international terrorists would seem more likely to make a run at those installations before challenging ours.

Terrorists with sufficient expertise and resources could in theory build a nuclear bomb but only with enormous difficulty. Starting a chain reaction is not simple. Highly enriched uranium—very problematic to acquire—would have to be correctly contained to obtain an explosion. Terrorists stealing an American nuclear weapon couldn't explode it without detailed knowledge of classified procedures that unlock numerous fail-safe mechanisms. Nuclear weapons that have been accidentally dropped from aircraft or involved in plane crashes, for instance, have not exploded. The reason: these devices are designed to blow up only when properly detonated.

Military Nuclear Waste

More than 61 million people live within 50 miles of temporary military nuclear waste sites, many of which hold—in antiquated, leaky enclosures or pressurized tents—the legacies of the Manhattan Project, the Cold War, and disarmament treaties requiring the dismantling of nuclear weapons. If politics do not interfere, within 10 years radioactive military waste will remain near 4 million people. In the 1980s, the Energy Department began a massive cleanup, the world's largest public works project ever. After a decade of delays and lawsuits by environmentalists, the WIPP opened in 1999. The satellite-monitored trucks that transport the waste have been highly and redundantly engineered, and their casks subjected to the same tests as those for commercial waste. Drivers are thoroughly vetted. Most shipments consist of mildly radioactive trash like coveralls, paper cups, and sludge. The debris is entombed half a mile underground in steel drums in a salt bed sandwiched between water-impermeable rock strata. The salt, plastic at that depth, and impermeable to radionuclides, even-

tually encloses the drums, providing another natural barrier.

An aircraft diving into an above-ground nuclear waste dump could not cause a nuclear explosion. The materials are neither refined nor concentrated enough to start a chain reaction. (Any material that could sustain one has been removed to be reused.) And because most high-level waste is isolated on big reservations like Hanford and Savannah River, which are fenced in and under heavy surveillance, casual access is highly unlikely.

Recently considerable apprehension has been expressed about nuclear materials being wrapped around conventional explosives to make a “dirty” bomb. This relatively low-tech approach appears more feasible than other threats and could induce widespread panic by appearing to expose a population to radiation. But how radioactive could such a bomb be?

Spent fuel would deliver the highest dose of radiation. Contamination from such a bomb would be serious. But wrapping the conventional explosives with spent fuel would be, as noted, a cumbersome operation and would promptly subject the perpetrators to fatal exposure. Suicidal terrorists might nevertheless make the attempt, but it would be surprising indeed if simpler projects that can also pack a big punch were not pursued first, even by fanatics who are less than entirely rational. Last winter's “shoe bomber” tried to detonate not a nuclear device but rather a relatively available, very dangerous chemical compound concealed in his shoes.

Neither medical nor WIPP-destined waste would provide much radioactivity because of the low concentration of radionuclides. More accessible materials (syringes, fly ash, uranium mine tailings, smoke detectors) could be included in a conventional bomb to make a Geiger counter tick a little faster, but physical damage from an explosion would be limited to what the conventional blast could do. Radiological harm would be negligible, if any occurred at all.

Further Steps

More must be done to secure our nuclear facilities. Operators must continue to improve safeguards, giving high priority to human engineering. Inexpensive but highly effective entry systems like those used at national laboratories should be instituted at power plants, and more fail-safe systems to compensate for human error ought to be installed. Safer, cleaner, more efficient reactor designs now exist and should replace outmoded ones. Without further delay, nuclear waste must be transferred to permanent repositories. Ultimately all nuclear facilities would be even safer if relocated underground. An infrastructure in which small reactors provided energy to regions, each independent of the national grid, would prevent a catastrophic nationwide power failure in the event of an attack.

In recent years, the Energy Department has tried to make its operations more transparent, but it still needs to reach out to the public to win trust. The technological and political communities—now sharply divided—must begin dialogues at both national and local levels. Because people are now recognizing as never before government's essential role in providing protection, aid, and counsel, the time is right for leaders and policymakers in both camps to clear up old misunderstandings. ■

The Deficit That Didn't Just Happen

By Allen Schick



A Sober Perspective on the Budget

It took the federal government 28 years (1970–98) to produce a budget surplus, but only 4 years to return to deficit. President Bush's 2003 budget promises that the government will have a surplus in 2005, but the revenue and spending policies it pursues risk another long spell of red ink that may extend well into the next decade, when the front edge of the baby boom generation reaches retirement age and both health and pension costs escalate.

Why the asymmetry in budget cycles? Why is the vicious circle of deficits so much longer than the virtuous circle of balanced budgets? If economic weakness impels government to spend more than it takes in, shouldn't the reverse also occur, that economic good times rescue the budget from red ink?

Part of the answer is that adverse budgetary effects of recession linger after the economy recovers. Recession lowers the trend line of economic growth, and it therefore takes a number of years to recover the lost output. Just a 1 percent drop-off in the 2002 growth rate would add \$50 billion to the deficit a decade later, even if full growth were to resume in 2003.

This is the no-fault part of the deficit story that the Bush budget emphasizes. But it is far from the whole picture. In fact, the Congressional Budget Office has estimated that less than one-quarter of the \$4 trillion in lost surpluses over the next decade is due to current economic difficulties. Most of the remainder is the result of political decisions to spend more and tax less. Two years ago in these pages, in "A Surplus, If We Can Keep It," I argued that policy mistakes caused the deficit surge in the 1980s and policy corrections stabilized federal finances in the 1990s. Critical turning points in budgeting don't just happen; they are the products of sound or flawed policies. No less than in the past, policy matters in budgeting. And policy mistakes are the reason why the fiscal outlook has rapidly deteriorated.

Policy mistakes are not simply matters of disagreement. They are inconsistent actions that cannot achieve purported objectives. Cutting taxes while steeply boosting defense spending in the early 1980s was mistaken because it generated huge deficits. Raising taxes in the early 1990s while constraining spending growth was sound policy because it enabled the government to successfully implement its deficit elimination strategy.

The government may now be at the cusp of another major policy error. It is not yet as big as the error two decades ago, but it risks becoming more damaging. The Bush budget story has three

interlocking chapters: spending decisions, tax legislation, and White House attitudes concerning surpluses.

Spending Our Way Out of the Surplus

The arrival of a surplus a few years ago triggered a spending frenzy that vitiated the discretionary spending caps established by the 1990 Budget Enforcement Act and made a mockery of the BEA requirement that increased spending be offset by cuts in other spending or by revenue increases. In 2000 and 2001, discretionary spending soared more than \$200 billion above the legal limits on annual appropriations. The caps expire at the end of 2002—which will at least enable politicians to be more honest about what they are doing. They no longer have to pretend that the census and other ongoing operations of government are national emergencies.

Defense is leading the spending parade, but it is not the only winner. In a replay of the policies of Ronald Reagan, Bush proposes to boost defense spending by \$85 billion over three years, with additional tens of billions for homeland security. In dollar terms, this defense buildup is bigger than the one undertaken in the early 1980s, but it is a significantly smaller share of GDP or of total federal spending. The odds are, however, that defense costs are understated in the budget. On the one hand, the president's State of the Union Address declares that "our nation is at war . . . and the civilized world faces unprecedented dangers." On the other hand, his budget projects that defense spending will decline by mid-decade as a share of GDP. Military leaders have already complained that the additional money is insufficient; they will not have to wait long to get more.

Bush has not proposed the wholesale elimination of domestic programs, preferring instead to hold many to approximately the previous year's spending level. This way, inflation does the cutting and the president can claim credit for some well-publicized increases. But the discretionary budget may be tighter than it appears, for it includes billions for homeland security and for the health care and pensions of federal employees,

which have been shifted from the mandatory to the discretionary budget. The CBO's baseline, which shows domestic spending keeping pace with GDP, would eat up most of the budget surplus promised by the president for the next decade.

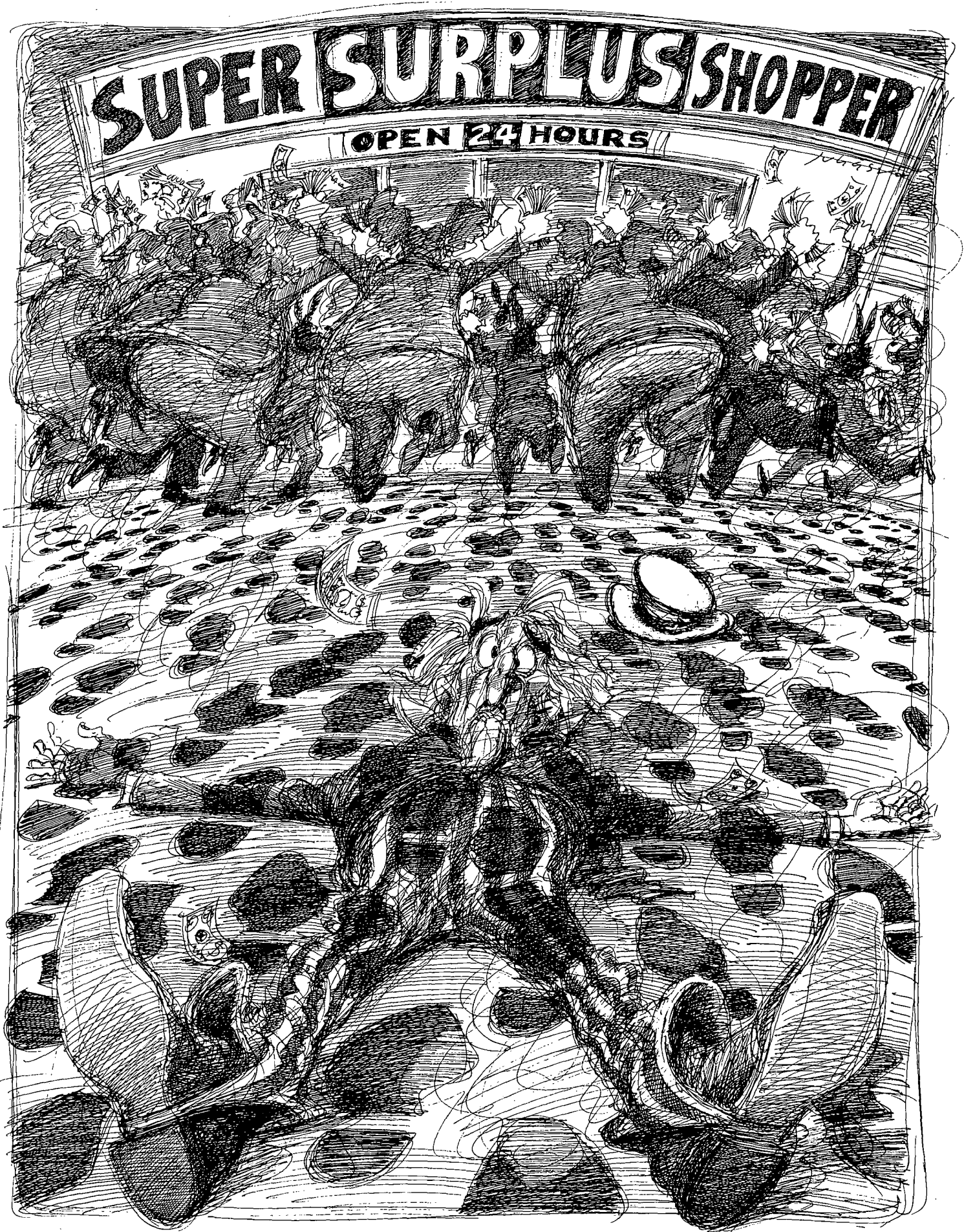
Entitlements are also likely to add to budget pressures. Congress must reenact welfare and agriculture legislation during the 2002 session, and advocates are demanding hefty increases. The president's Medicare numbers are \$300 billion (over the next 10 years) below CBO's baseline. He expects the rise in Medicare spending to decelerate despite the increase in the number of older Americans covered by Medicare.

Summing up the expenditure story, in the next decade the government will spend more than it did in the recent past and more than the president has projected in the budget. The era of big government may be over; the era of big spending is not. The question is, will government have the money to pay for it?

The Power Not to Tax

Judging from the Bush budget, the clear answer is "no." George W. Bush may be the first president in American history to declare war and demand tax cuts. He wants almost \$700 billion in tax cuts over the next 10 years, on top of the \$1.3 trillion cut enacted last year. The true size of that cut was masked by artfully placed phase-ins and phase-outs. Some cuts were scheduled to take effect near the end of the 10-year period; most would phase out during or at the end of it. Fully implemented, over the course of a decade the cuts would subtract almost \$2 trillion from federal revenue.

Despite its search and destroy mission to find and liquidate provisions of the tax code, the administration would allow the alternative minimum tax (AMT), which may be the most disliked feature of the tax code, to ensnare millions of Americans in coming years. The AMT was originally designed to curb aggressive tax avoidance, but because it is not indexed for inflation, increasing numbers of people will face the AMT in future years for reasons completely



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unrelated to tax sheltering. Last year's tax cut granted taxpayers a temporary reprieve from the AMT, but that relief expires in 2004. Apparently, even the White House could not afford the \$500 billion (over 10 years) price tag of fixing the AMT problem. An alternative take is that the president knows Congress will be pressured to act and that if he gets his additional tax cuts and Congress fixes AMT, the combined revenue loss would be even higher. A final spin on the administration's oversight is that once millions of taxpayers have to pay AMT, they will be so angry as to undermine public support for taxes. Whatever the true motive, the downstream loss in revenue may be even higher than the administration has forecast.

One need not wait long to see the effects. The 2003 budget shows two consecutive years—2001 and 2002—of decline in federal revenues, the first time that has happened since the end of World War II, when the United States shifted from full mobilization to peacetime. Even if no new tax cuts are enacted beyond those already adopted, the federal government faces a structural imbalance that is being masked in the short run by Social Security surpluses but will become apparent less than a decade from now. The administration has ignored the dire future by departing from past budget practice and shortening the budget's time horizon from 10 years to 5. Of course, this does not stop it from promoting permanent tax cuts whose budget impact will be fully felt after the foreshortened 5-year period has ended

The Political Logic of Unbalanced Budgets

The White House is not clueless as to the fiscal course it has charted. This is not a case of ignorance aforethought. The administration knows what it wants and is setting out to get it.

During the Reagan era, when serious policy mistakes led to a fivefold escalation in public debt from \$700 billion to \$3.5 trillion, Senator Daniel Patrick Moynihan accused the administration of creating the deficit to starve the government of revenue. Moynihan did not have a smoking gun to confirm his hypothe-

sis, but George W. Bush has supplied one. Several weeks after taking office, the Bush White House published *A Blueprint for a New Beginning*, with a chart titled "Budget Surpluses Lead to Bigger Government." If this is so, the prudent thing to do is to get rid of surpluses; otherwise, government will grow bigger. Many conservatives have accepted as an article of faith that government spends any money it has and that the only effective way to constrain spending is to take away the surplus. In their mind, it is better to have a smaller government with a bigger deficit than a bigger government with a smaller deficit.

The problem with this point of view is that even if the government is broke, it will spend more. One reason is that big government includes big defense. In an age of terrorism, the Pentagon will not spend less because the government has red ink. Another is that, as David Stockman, Reagan's budget director, discovered two decades ago, Republicans also beat the drums for more spending. Stockman labeled this phenomenon "the triumph of politics," which became the title of his surly memoirs on his service in the U.S. government.

The third, most compelling reason for more government spending is that higher spending is built into the demographics of American life. We are now two decades closer in time, but no closer in solution, to the baby boom surge. These costs will have to be faced, regardless of the government's financial position. Some cynics think that the White House understands the mammoth costs that lie only a few years ahead, but that it is driven by the conviction that only a full-blown financial crisis will build support for privatizing all or a big portion of Social Security and Medicare. It believes that as long as Uncle Sam can afford to pick up the tab, there will be no pressure to fundamentally restructure these retirement programs.

We may, however, get only the crisis part of this scenario, in which case the administration is taking truly enormous risks with the future well-being of the United States. As the title of this article says, this deficit didn't have to happen. And it shouldn't. ■

Three Pollutants and an Emission

(continued from page 17)

Every negotiation is shaped by expectations about what will happen if it breaks down. If the multipollutant debate collapses, what is expected is a return to the status quo—the so-called emission baseline. But like so much in this debate, the baseline itself is uncertain—so much so that the parties may find it more useful to compromise over legislation than to continue the familiar battles over a shifting baseline. Environmental advocates feel that regulatory inertia favors continuing reductions in conventional emissions. Regulatory calendars stretching to 2015 foresee the implementation of new particulate standards, mercury controls, and regional haze rules that will affect the various emissions individually. But advocates of multipollutant legislation have to feel their possible advances are at risk under the Bush administration.

The bellwether may be how the administration completes its ongoing review of NSR. If it backs away from proposed changes that would give power plants more freedom to expand or modernize without coming under NSR requirements, industry may feel it has the most to gain from legislation. If the administration review leads to substantial revisions or elimination of NSR, the baseline will be changed. Either fur may fly in Congress, or the stage may be set for an important compromise around multipollutant legislation. Or maybe both. ■

Corrections

In the winter 2002 issue, Yaakov Kop should have been identified as the co-author with Robert Litan of the article "Diversity in Israel."

In the winter 2002 issue, Peter H. Schuck, author of "Affirmative Action," was identified as professor of law at Yale University and New York University. He has offices at New York University but is not a professor there.

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